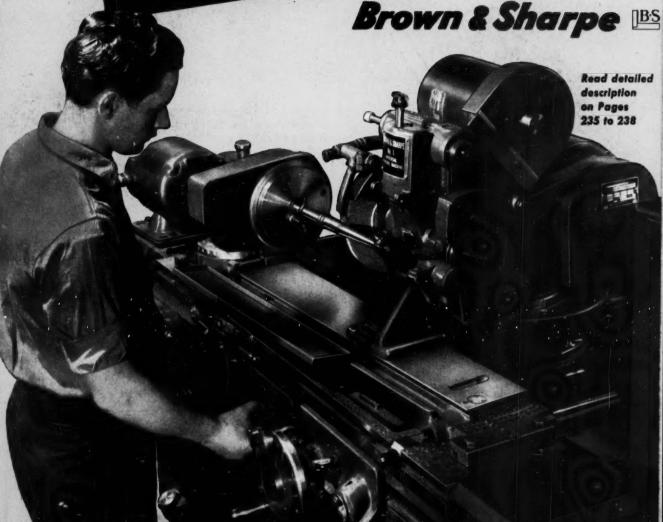
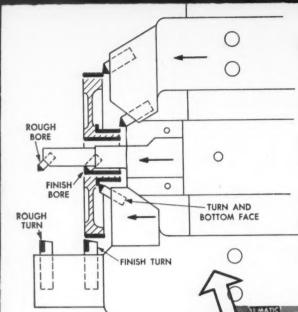
MAY, 1953 - FIFTY-NINTH YEAR

MACHINERY

COMPLETELY NEW LINE OF UNIVERSAL GRINDING MACHINES

Now handle more jobs faster . . . instant combining of separate manual operations into automatic cycles extends the usefulness of this equipment beyond the toolroom and job shop to many production applications.





multiple surfaces get the

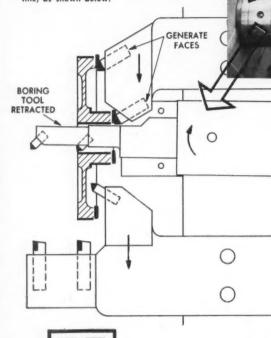
ALL-OVER

borizing treatment

Model 222 Bore-Matic precision finishes helical gear blanks on all contact surfaces in continuous-production setup

1st Operation, left end stations: load, table rapid traverses left, slows to rough bore and turn, then slows further to finish bore, turn and bottom face, as shown above.

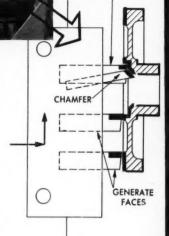
2nd Operation, left end stations: contact switch starts cross-slide forward to generate face of part, automatically shifting bridgedover dial-bar boring tool to eliminate drag line, as shown below.



With the tooling arrangement shown above, this four-station, double-end machine turns out precision borized cast iron gear blanks two at a time — with no time out for loading and unloading.

Each blank is bored, faced, turned and chamfered on a total of eleven surfaces. Parts are bored, turned and faced on flange end at the two left-hand stations, both 1st and 2nd operations being done at each station. Then parts are transferred to the right-hand stations for the remaining operations. The operator is able to load one end while the other end is borizing, eliminating handling time from the work cycle. The machine cycle and sequence of operations are illustrated in the accompanying diagrams.

Remember—when it comes to precision finishing, it pays to come to Heald.



PLUNGE DIAMETER AND GENERATE FACE

For final operation on right end of machine, table rapid traverses right and cross slide indexes to rear to finish two faces and a chamfer, as shown above.



Case Study No. 2238-96 in INTERNAL AND ROTARY SURFACE GRINDING MACHINES AND BORE-MATICS

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

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Editorial, Advertising and
Circulation Offices
148 Lafayette St., New York 13, N. Y.

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THE INDUSTRIAL PRESS
Publisher

ROBERT B. LUCHARS
President

EDGAR A. BECKER Vice-President and Treasurer

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WALTER E. ROBINSON
DWIGHT COOK

148 Lafayette St., New York 13, N.Y.

GEORGE H. BUEHLER 228 N. LaSalle St., Chicago 1, III.

NORMAN O. WYNKOOP, Jr. 17597 James Couzens Highway Detroit 35, Mich.

DON HARWAY & COMPANY 1709 W. Eighth St., Los Angeles 17, Calif.

MACHINERY, published monthly by The Industrial Press, Emmett St., Bristol, Conn. Executive offices 148 Lafayette St., New York 13, N.Y.

Subscription Rates: United States and Canada, one year, \$4; two years, \$7; three years, \$8; foreign countries, one year, \$7; two years, \$13. Single copies, 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address. Copyright 1953 by The Industrial Press.

Entered as second-class mail matter, September, 1894, at the Past Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America. Application for reentry at Bristol, Conn., pending.

> British Address National House, West St. Brighton 1, England







MACHINERY

VOLUME 59

MAY, 1953

NUMBER 9

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

•	Bending Hollow Rectangular Tubing at Raytheon By Harry F. Clarke	170
F	Fundamentals of Production Tapping By R. H. Cowan	175
	Factors in Choosing and Using Hydraulic Press Oils	
	By H. P. Laussucq	179
	Ultrasonic Cleaning of Metal Parts with Ceramic Transducers Conveyor for Handling 250 Tons of Scrap per Day	185
	Bu Charles H. Wick	191
N	Northrop Plant Producing Range Finders for Tanks	194
	Milling Rotor Blades for Ram-Jet Engines	200
T	Jseful Drilling Information (Data Sheet)	257

MACHINE AND TOOL DESIGN

Cost-Cutting Dies By Peter S. Tobias and Carl Erickso	n 155
Dimensions and Tolerances for Mass Production	
By Earle Buckingha	m 163
Hopper Feeds for Bottle Caps By Joseph and Vincent Waitku	
Lever Type Clamps for Jigs and Fixtures By W. H. Litte	
Finger Clamp for Non-Parallel Surfaces By W. M. Hallida	
Bench Grinder Wheel-Truing Device By William C. Bet	0
Method for Off-Center Drilling of Cylindrical Parts	20%
By A. E. Rylande	r 205
By A. E. Ryanae	
Semi-Automatic Stop for Blanking Dies By Federico Strasse	r = 206
Linear Movement Reduced by Differential Chain Drive Mechanis	m
By L. Kaspe	
	201
Positive Ratchet Mechanisms Designed for Silent Operation	
By Haim Murr	0 208

MANAGEMENT PROBLEMS AND MEETINGS

Clearing Away the Road Blocks By Loring F. Overman	151
	-
Let's Pull Together or We'll Pull Apart By Charles O. Herb	153
Machine Tool Industry in Transition—Theme of Meeting	210
Machine Tool Distributors Hold Meeting in Cincinnati	212
Our Attitude Toward Competition By Bernard Lester	214
Westinghouse Machine Tool Electrification Forum at Pittsburgh	268

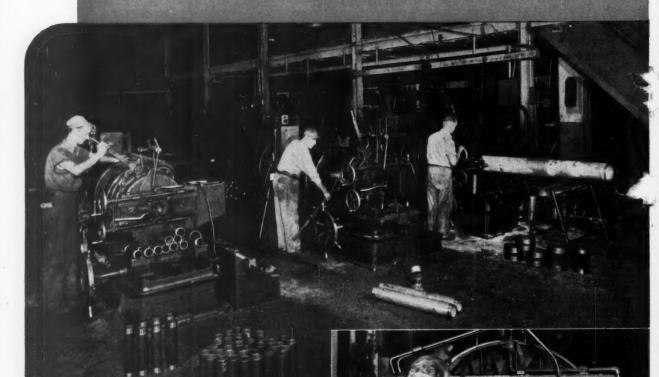
DEPARTMENTS

Keeping up with Washington .	151	The Sales Engineer	214
Materials of Industry	188	The Latest in Shop Equipment	216
In Shops Around the Country	198	New Catalogues	
Tool Engineering Ideas	203	Between Grinds	253
Ingenious Mechanisms	207	News of the Industry	254
Questions and Answers	213	Data Sheet	257

Product Directory 307



Advertisers Index 449-450







THREADING MACHINES

Major Features Increase Efficiency

I. WIDE RANGE

Just three LANDIS Pipe Machines (2", 8" and 18") will thread all diameters of pipe from ½" to 18". Each machine is constructed so as to handle a wide range of pipe sizes—for example, the 6" machine will thread all diameters from 1" to 6". Universal size adjustment allows quick set-up.

2. DIE HEAD EFFICIENCY

The design of Stationary heads provides maximum rigidity on all diameters within their range. Positive locking action is assured through a self-locking toggle joint. Size adjustment is quickly and easily obtained through use of a single locking nut.

2. LOW TOOL COST

Chasers operate at a tangent to the work. Line contact at cutting edge re-

duces friction. Permanent throat assures even chip distribution. Variable rake affords proper cutting edge for different materials. Landis chasers are useable for 80% of their original length. They are individually replaceable and, within the range of a given die head, a single set of Landis chasers can be used for all diameters of the same pitch, form and taper.

4. PRICISION TAPARED THREADS

The Receding Chaser Pipe Machines are especially designed to cut tapered threads to meet A.P.I. requirements. Chasers recede into the die head at a rate equal to the taper of the thread, ensuring accurate and uniform taper along the full thread length.



COMPANY

WAYNESBORO PENNSYLVANIA

TULSA OIL SHOW-BOOTH 17018, CALIFORNIA BUILDING

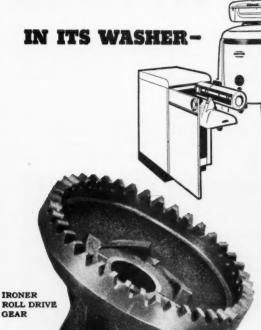
Why Blackstone uses

FELLOWS

Diameter of Gear Number of Teeth Face Width of Blank Pitch Pressure Angle Blank Material Gear Shaper Strokes per rev. of cutter Number of Cuts Taken Feed per Stroke — Finishing Production Rate (Pieces per Hour) Governing Tolerances

WRINGER GEAR

Fellows-cut Face Gears



PERFORMANCE TABLE

WRINGER GEAR	IRONER GEAR
2.813	2.837
25	42
3/16	5/32
10/12	16
20°	20°
C-1010 SH SAE	CAST IRON
1620	893
1	1
.002	.004
18	13
.002	.002

IRONER PRODUCTS

Well made products that give long-time, trouble-free service to the user are sure to gain his continued satisfaction.

Blackstone builds just such products—and by so doing maintains its outstanding reputation for quality in the highly competitive electrical appliance field.

The use of face gears and pinions cut on Fellows Gear Shapers is one of the contributing factors to the success of Blackstone equipment. Production costs are low because these gears are easy and economical to produce and assemble. Quality of product is maintained because they transmit power quietly and efficiently. Long-time, trouble-free service is assured because they provide the smooth running action and the tooth strength needed to reduce the possibilities of breakdown to the minimum.

Contact the nearest Fellows office for details on the way you can take advantage of Fellows experience in furnishing up-to-date solutions to your gear manufacturing problems.

DATA SHEETS describing a simplified procedure for determining the active face width for "on-center" and "off-center" face gears are available.



THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department : 78 River Street, Springfield, Vermont Branch Offices: 323 Fisher Bldg., Detroit 2 • 5835 West North Ave., Chicago 39 • 2206 Empire State Bldg., New York I



Why not take FOR

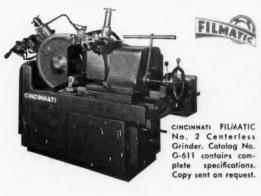
Left: These widely differing parts were all finished economically by centerless grinding. Materials include iron, steel, stainless steel, brass, aluminum, plastic.

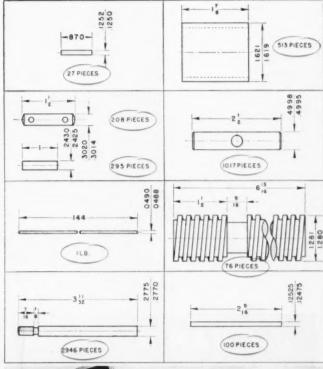


GRINDING SMALL QUANTITIES

Nearly everyone knows about the advantages of centerless grinding large quantities of parts on a cincinnati FILMATIC No. 2 . . . the uniformly high quality of performance . . . simplicity and ease of operation . . . low cost of production. But not many know that these advantages can also be realized for wide varieties and small quantities of parts assigned to a CINCINNATI. How can it be done? There are two main considerations: 1) Group together all parts requiring a particular type of setup. You will eliminate frequent changes from thrufeed to infeed jobs. 2) Group all parts together by diameter. It takes less time to change the setup for a small difference in diameter than a large difference. ¶It will certainly be to your advantage to investigate CINCINNATI FILMATIC No. 2 Centerless Grinders for a wide range and small quantities of parts. A more complete story of economical small parts production may be obtained by writing for "Principles of Centerless Grinding," publication No. G-503-2.

CINCINNATI GRINDERS INCORPORATED CINCINNATI 9, OHIO







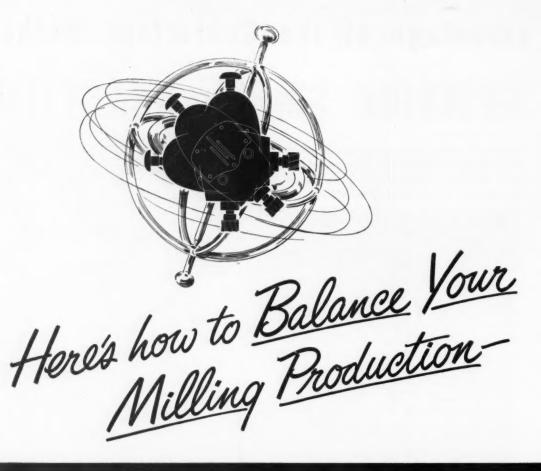
This booklet "Principles of Centerless Grinding" explains the principle of operation; tells how to set up and estimate production for "CINCINNATI FILMATIC Nos. 2 and 3 Centerless Grinders. The illustration above appears under the subject "How to Economically Grind Small Lots on a Centerless." Write for a copy of this informative booklet—publication No. G-503-2.

CINCI

Left: Close-up of a CINCINNATI FILMATIC No. 2
Centerless Grinder set up for a typical infeed job. The Hydraulic Profile Truing equipment over the regulating wheel is especially desirable on machines used for small lot production.

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES



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Van Norman Ram Type Millers enable you to meet all milling jobs and keep all machines operating, saving you money by eliminating idle machine time so often encountered with single purpose machines. These advantages multiply if you have a number of RamType milling machines in use.

In addition, the adjustable cutterhead cuts idle machine time caused by work reset-ups by as much as 50%. Because the work stays in the original set-up, errors are eliminated, accuracy improved.

Find out how you can save with these versatile millers. Write for catalog, today.

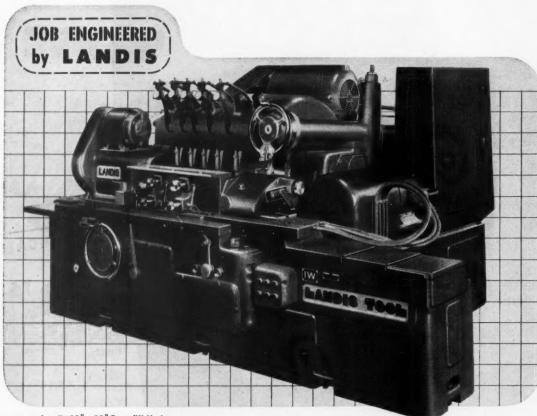
VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS, U. S. A.



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Landis 10" x 30" Type IW Hydraulic Grinder for grinding multiple diameters in one operation straight, tapered, shaped or in combinations. IW's are made in 2 sizes.

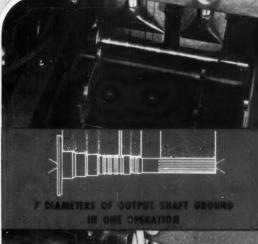
The Multiple Wheel Grinder is a good example of JOB ENGINEERING by LANDIS. This grinding method was developed to solve a specific production and quality control problem. Advanced design makes it possible to grind a great variety of parts. The result is a machine that pays for itself fast... that brings users higher returns than was ever thought possible.

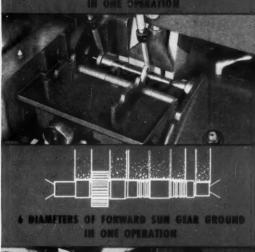
Want an idea on how LANDIS JOB ENGINEER-ING can help you cut costs of your grinding operations? Send us your part prints and production requirements. We'll give you tooling and production estimates at no obligation.

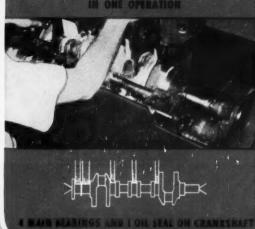
LANDIS

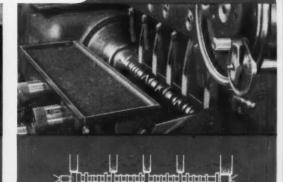
precision grinders

JOB ENGINEERED by LANDIS

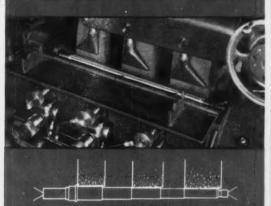




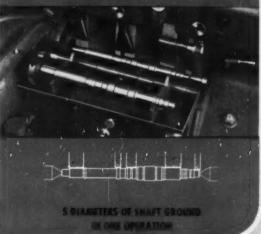




5 LINE BEARINGS GROUND IN ONE OPERATION

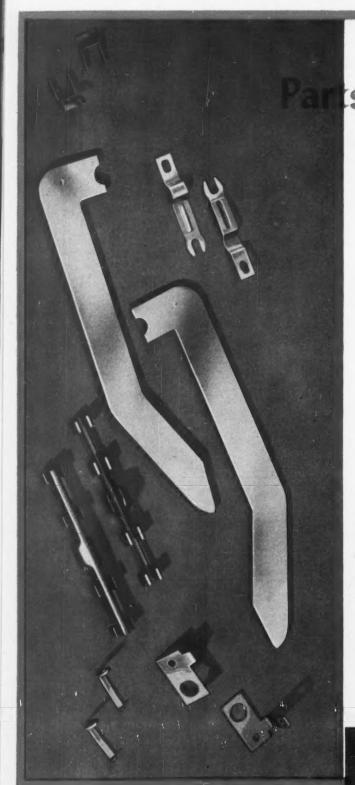


3 DIAMETERS OF COMPRESSOR SHAFT GROUND IN ONE OPERATION



LANDIS TOOL COMPANY . WA

WAYNESBORO, PENNSYLVANIA, U. S. A.



Produced Using U. S.

The parts illustrated at the left are just a few of the different types of metal stampings being produced at Proctor Electric Company on conventional punch presses arranged with U. S. Slide Feeds, Stock Straighteners and Stock Reels.

The photograph at the right shows a typical setup of conventional punch press equipped with U. S. Slide Feed, Straightener and Stock Reel for holding the coils of material.

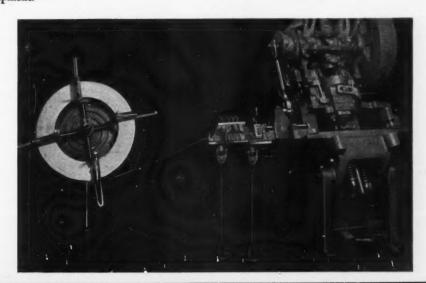




The production program at Proctor Electric Company, Philadelphia, Pennsylvania, famous manufacturers of appliances, calls for the fabrication of many different types of metal stampings for use in Proctor Irons and Toasters.

The precision inherent in end products of this type naturally results from the accuracy with which the component parts are produced. To insure the desired result, conventional punch presses at Proctor Electric Company are equipped with U. S. Slide Feeds and Straighteners. U. S. Slide Feeds are generally recognized for their extreme accuracy, dependability and versatility. The U. S. Slide Feed can pull material (within its capacity) through a plain stock straightener and still maintain controlled accuracy of feed length. Also, U. S. Slide Feeds can operate at speed as high as can be provided by conventional punch presses.

If your operations include the production of metal stampings, ask for a copy of Bulletin 80-M on U. S. Automatic Press Room Equipment.

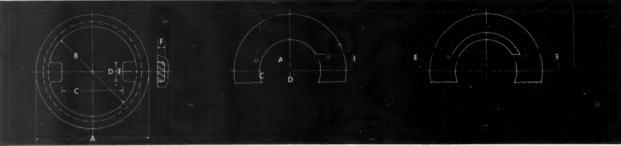


COMPANY, Inc. AMPERE (East Orange)
NEW JERSEY

Builders of U. S. Multi-Skides-U. S. Multi-Mills
U. S. Autgonafic Press Room Equipment-U. S. Die Sets and Accessories

PRODUCTION TIME





(A) 6" (B) 4%" (C) $3\frac{1}{4}$ " (D) -1" $+\pm.000$ (E) -1" $+\pm.005$ (F) $3\frac{1}{4}$ "

OPERATION 1 — Rough mill one side of tongue. PROCEDURE — Offset spindle slide radius (A), set rotary head to angle (B), feed table to workpiece centerline (C to D). OPERATION 2 — Rough mill radius section between tongue.

PROCEDURE — Rotale head from angle (B) to angle (E).

REDUCED BY 53%!

Rotary Head Milling Machine simplifies method and cuts costs on still another production job



-

Here's the completed workpiece together with two pieces of waste.

IN production of this Quick Change Clamp Collar, considerable savings were effected by using a versatile Kearney & Trecker No. 2 Model D Rotary Head milling machine.

The radius of the piece was produced merely by offsetting the spindle slide and rotating the machine's head. The job was done faster, more accurately than would be possible with any other method.

Practically no other standard machine can mill these parts without a change in setup and cutters, maintain accuracy, yet complete the job in less than 16 minutes!

For details of this operation, see the diagrams below. Note: Model D's table and saddle movements are independent, will not affect the radius setting—think what that means not only to this job, but also in terms of a wider range of applications for other work.



Here's the Rotary Head Milling Machine Production Idea Booklet. It contains several examples of how this method has been found exceptionally efficient in solving production, die, forging and metal pattern milling problems. It's yours for the asking.

Address requests for booklet to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.







OPERATION 3 - Rough mill one side of opposite tongue.

PROCEDURE—Feed Machine table from (D) to (F).

OPERATION 4 - Rough mill end of tongue.

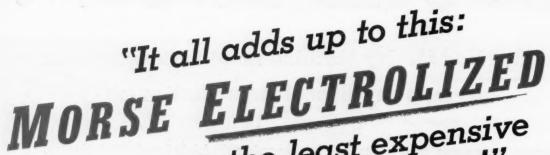
PROCEDURE—Feed machine saddle from (F) to (G).

OPERATION 5 - Rough mill second half of inner contour.

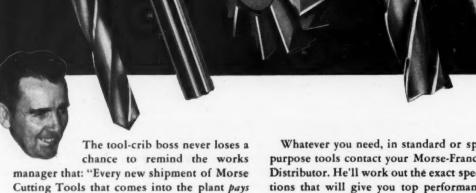
PROCEDURE — Repeat Operations 1 through 4, working area to be in the lower half of opening.

OPERATION 6— Finish mill 4% dia., end of tongues to 3% dimension and width of tongues to 1% \pm .000 —.005.

PROCEDURE — Reverse sequence of Operations 1 through 5.







That's right. For what Morse Tools really cut are costs... by cutting cleaner and faster... by staying on the job longer. And then, of course, to go even further and get the unmatched maximum in tool-life, specify Morse Electrolized Tools.

another bonus in plus-production!"

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MORSE TWIST DRILL & MACHINE COMPANY NEW BEDFORD, MASS.

(Division of VAN NORMAN CO.)

Warehouses in New York, Chicago, Detroit, Houston, San Francisco

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Distributor and save ordering time

MACHINERY, May, 1953-17

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How to reduce out-of-line when machining outsize

Increased work capacity of G&L 50 Series Horizontal Bar with new underarm support slashes handling, setup and job time on these difficult 100-ton steel castings

OPEN construction plus the new underarm arrangement of the G&L 50 Series Horizontal Boring, Drilling and Milling machine has greatly simplified the job of machining these huge rolling mill housings.

High accuracy as far as 60 from headstock

This new development permits many milling, facing and boring operations in one setup...at right angles to the spindle...as far as 60" from the headstock. An offset milling head can be mounted on the support to reach limited-access surfaces. And flatness and parallelism of all milled surfaces are held to close limits.

For example: With the housing set on its side (see photo) it's possible to mill and bore the inner window surfaces... in fact the complete "window" in one setup. When the operation shown is completed, the operator merely rotates

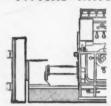
the angular milling attachment to mill the upper angular surfaces. The machine spindle drives the cutter through gears in both the anti-friction bearing support block and the milling head.

Cross feed is accomplished through synchronized movement of the underarm and spindle. Longitudinal feed movement of the machine column on its runway is used to mill the upper and lower side sections of the window.

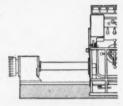
Do you need extra capacity?

This new underarm support is available on all new G&L 50 Series Floor type machines (6" or 7"). If you'd like to know how you can keep handling, setup and labor costs in line when working with huge castings, contact your nearest G&L representative or write direct. BUT DON'T DELAY... DELIVERY ON G&L MACHINES MAY BE BETTER THAN YOU THINK.

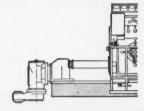
TYPICAL WAYS YOU CAN USE UNDERARM ARRANGEMENT.



Underarm extended spindle support with continuous feed facing head.



Underarm extended spindle support with face mill.

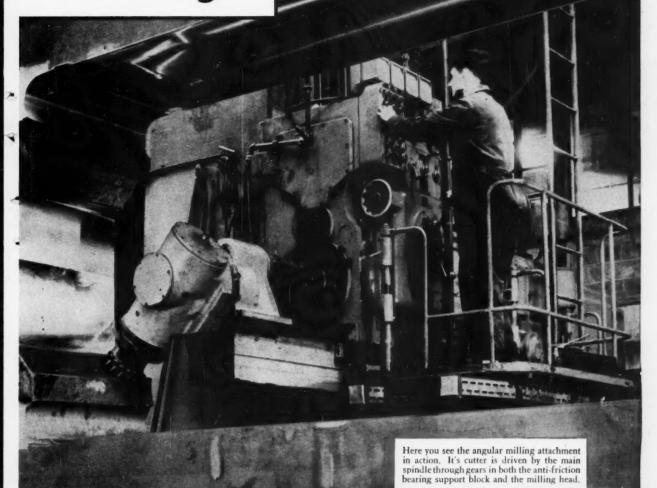


Underarm right angle swivel milling attachment with offset arrangement.





costs... castings



SEE US AT THE CANADIAN INTERNATIONAL TRADE FAIR—TORONTO, JUNE 1 TO 12

G-23

MACHINE TOOL CO.



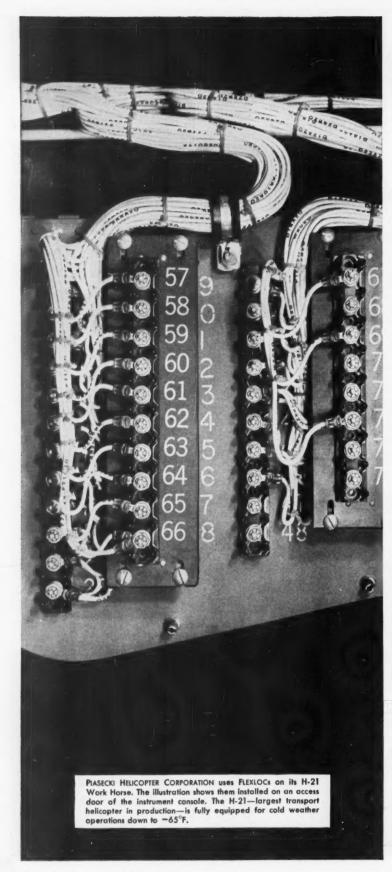








FOND DU LAC WISCONSIN





Why use FLEXLOC locknuts?

The answer is simple. They hold assemblies together, and won't work loose like ordinary nuts. Once you install these one piece, all metal nuts, you can forget them. Yet they can be easily removed and can be reused again and again.

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SPS can deliver any quantity of FLEXLOCS in a wide range of sizes. Stocks are carried by industrial distributors. Write for literature and samples. SPS, Jenkintown 19, Pa.



LOCKNUT DIVISION



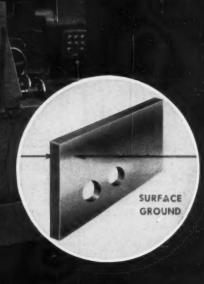
Our Fifteth Year : A START FOR THE FUTURE

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CUTS COST 75%!

TWO Surfaces Ground in ONE Operation

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JOB DATA

MACHINE: Gardner 84B-30" Double Spindle Grinder.

PRODUCTION AVERAGE: 4 to 6 pieces per minute per cut for doors up to 6" x 10"; maximum work size, 12" x 12".

TOLERANCE: .001" to .002" for parallelism. .005" for uniformity.

For help with your flat surfacing problems, send us your blueprints for production estimates and tooling suggestions.

GARDNER MACHINE COMPANY 414 Gardner St., Beloit, Wisconsin, U.S.A. GARDNER Grinders

There's a <u>simple</u> way to solve what appears to be a complex speed reduction problem

Get the proper drive combination that best meets your requirements from the broad LINK-BELT line

You'll find your power transmission costs are lowered several ways when you use Link-Belt enclosed gear drives. First, Link-Belt offers a broad range of types and sizes in helical, herringbone and worm gear designs. You get the one reducer best suited to your needs.

In addition, Link-Belt builds a complete line of power transmission machinery. Installation and alignment are simplified because dimensions of Link-Belt chains and sprockets, bearings and couplings are all coordinated. And there's no need to call in another firm for any information or assistance.

This overall integration—plus the long life built into every piece of Link-Belt equipmentguarantees optimum efficiency. Result: lower power consumption and maintenance costs.

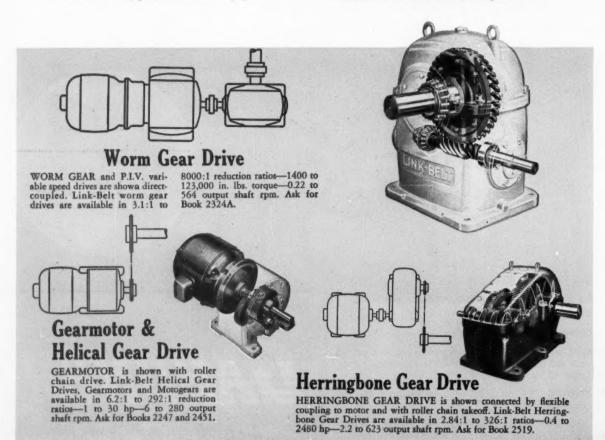
Make the nearby Link-Belt sales office or distributor your power transmission headquarters. Nowhere else can you get the great selectivity that assures you of the best in enclosed gear drive applications.



ENCLOSED GEAR DRIVES

18,127

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices, Factory Branch Stores and Distributors in Principal Cities.





THE WINNER!...for lowering costs

Pick pink CIMCOOL° and you'll be way out front—all the way, and in every way. Because this radically new and different cutting fluid does a better job and saves you money in three important ways:

CIMCOOL INCREASES TOOL LIFE (and thus reduces down time) because of its chemical lubricity.

FASTER SPEEDS are possible because Cimcool cools faster, through a unique physical change in the cutting fluid itself. Tools and chips actually stay cool to the touch.

CIMCOOL COSTS LESS than old-fashioned cutting fluids because it lasts longer. It also cuts labor costs for cleaning and changing. It virtually eliminates rancidity and foul odors. And because of its low surface tension and low adhesion to work and chips, there is practically no carry off.

Let us show you how Cimcool can put your plant in the winning circle. Write us for a demonstration in one of your own machines. We'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet, "Cimcool Defeats Heat." Address, Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

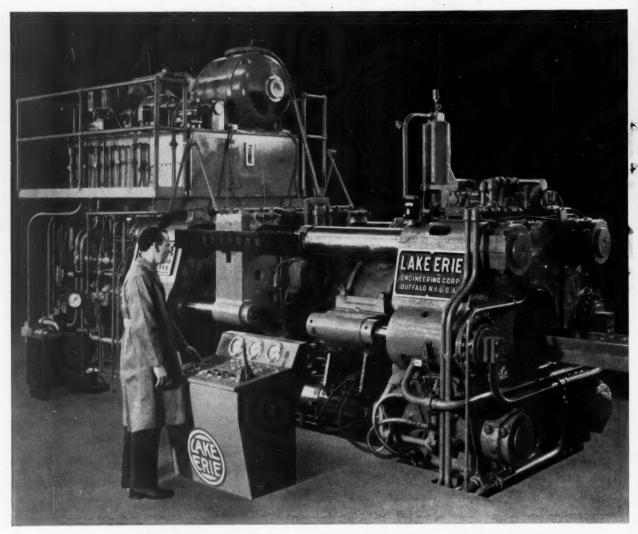
*Trade Mark Reg. U.S. Pat. Off.

CIMCOOL!

for 85% of all metal cutting jobs

A PRODUCTION PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE COMPANY

BIGGEST NEWS OF THE



THE 1250 TON LAKE ERIE extrusion press has a self-contained pumping unit and electrically heated container. Elimination of the gate lock and die runout table make this design far more compact and rigid. New swinging die arm illustrated on opposite page takes their place.

7 MAJOR FEATURES REVEALED

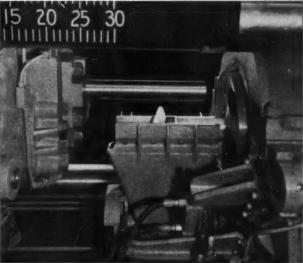
- 1 New swinging die arm eliminates gate lock and die runout table... speeds die changing...greatly reduces maintenance.
- 2 Shorter stroke increases speed and decreases maintenance.
- **3** Container supported on centerline of press prevents changes due to heat expansion.
- 4 Loader for billets and dummy blocks simplified.
- 5 Special control permits exact speed adjustment to suit the work.
- 6 Interlocks prevent accidents.
- 7 More compact design saves large floor area...increases rigidity of press.

DAY FOR EXTRUDERS...

the most important improvements in extrusion press design in years!



VIEW SHOWING the swinging die arm which pivots about one of the lower columns. "Horseshoe" cavity at top of swinging die arm carries the die holder with the die and separate backup block.



THE BILLET LOADER is of simple, unique construction consisting of a V-block mounted on an arm pivoted on the vertical centerline of the press. The extrusion stem is mounted on a vertical slide.

By combining experience in non-ferrous extrusion press construction with that in the related fields of hot and cold steel extrusion, Lake Erie engineers have come up with the most important improvements in extrusion press design in years. The 7 big features culminate two years of intensive research and development work. This includes the construction and operation of a test installation, and an actual production demonstration for extrusion engineers and executives from leading plants. Here is machine development at its best—the retention of fundamental design...the application of improvements based on related experience...the development and testing...and finally the actual demonstration of results. By all means, see for yourself what this superior type of nonferrous extrusion press can do for you. Write or call us.

ENGINEERING CORP. BUFFALO. NY. U.S.A.

MANUFACTURERS OF HYDRAULIC PRESSES AND DIE CASTING MACHINES

General Offices and Plant

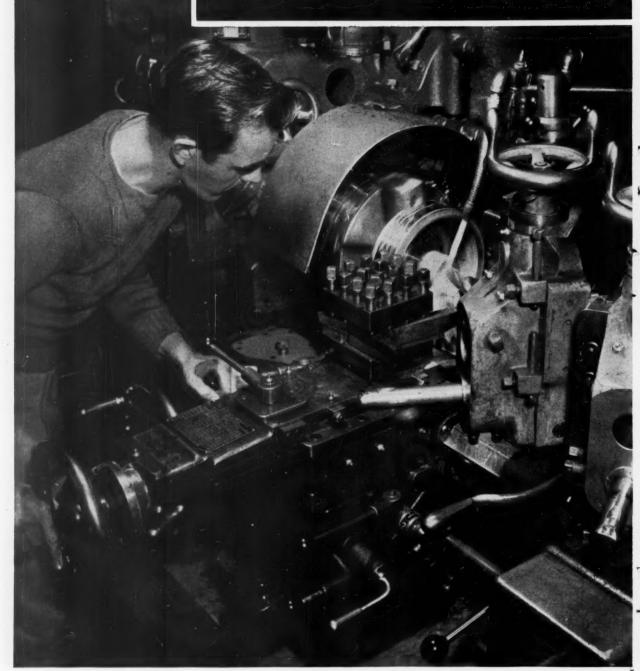
170 Woodward Avenue, Buffalo 17, New York

LAKE ERIE HYDRAULIC PRESSES are available in any size... standard, modified and special designs—horizontal and vertical types—for Metal Working—Plastics Molding—Forging—Metal Extrusion—Processing—Vulcanizing—Laminating—Stereotype Molding—Matrix Forming—Briquetting—Baling—Special Purpose.

District Offices in NEW YORK • CHICAGO • DETROIT • PITTSBURGH & bresimatives in Other Principal Cities in the United States and Foreign Countries Manufactured in Canada by: Canada Iron Foundries Limited

LAKE ERIE (P)

JOB LOTS..

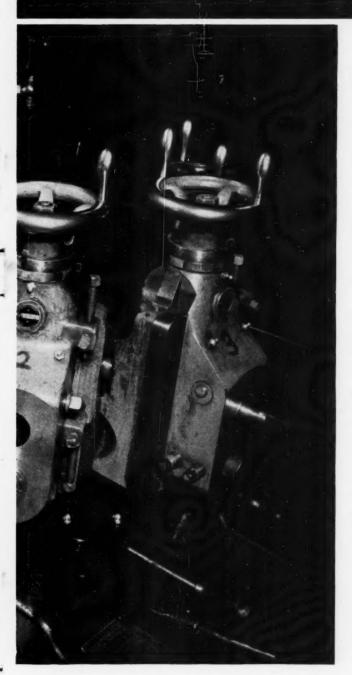


A steel forged drive gear for Diesel locomotives being machined on a Warner & Swasey 1-A Turret Lathe. Limit: .0005" on O. D. of bub. Pieces in lot: 20. Repair parts for locomotives are also made on this machine.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY

28-MACHINERY, May, 1953

LARGE OR SMALL



No Problem at American Locomotive

WHEN YOU MUST MACHINE a wide variety of jobs in various lot sizes—sometimes even single pieces—you must use turret lathes on which jobs can be set up quickly, changed with little downtime. American Locomotive has found they can handle these jobs *profitably* on Warner & Swasey Turret Lathes set up with Standard Universal Tooling.

At the Diesel Engine Division in Auburn, New York, six different model Warner & Swaseys are used on a variety of jobs ranging from lots of 6 to 500 pieces. Repair parts are also handled on these machines. These turret lathes turn everything from gray iron castings to tough alloy steels and hold limits of .0005".

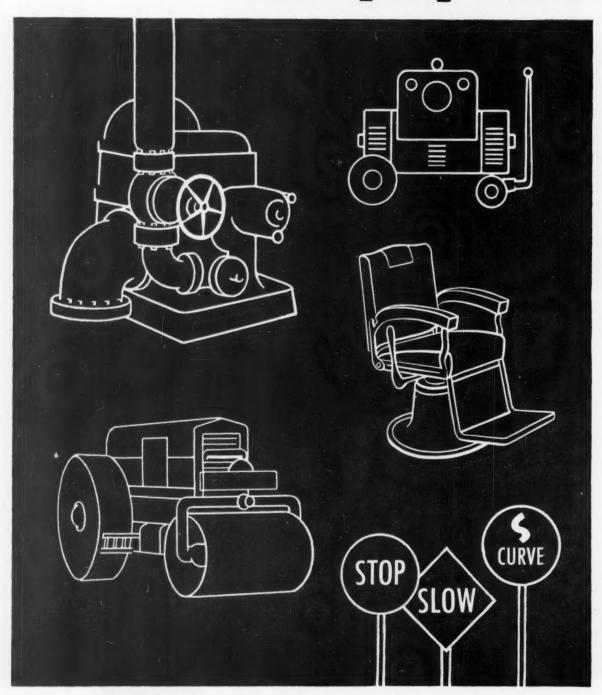
American Locomotive experience proves jobs can be switched quickly on these Warner & Swaseys. Warner & Swasey power handles heavy multiple cuts. Warner & Swasey speed permits most efficient use of carbide tools. Rigid Warner & Swasey design guarantees lasting accuracy.

Warner & Swasey Turret Lathes have proved themselves profitable in handling precision jobs of many different kinds in thousands of plants — on job lots, large or small. So before you invest in any machine tools, call in your nearest Warner & Swasey Field Representative and find how Warner & Swasey can improve production and build profits for you.



MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

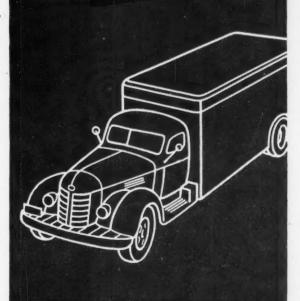
Lowe Brothers ZINOXIDE cuts spray booth



ZINOXIDE is the ideal time-saving, money-saving primer for a wide variety of products—turbines, barber chairs, road rollers, welding equipment and road signs, to mention just a few. It adheres perfectly to all types of metal — even aluminum!

Primer handling time in half!

produces a better looking jobpractically eliminates sanding



An Extra ZINOXIDE PLUS! Contains 2 of the best corrosion resisting pigments known to the paint industry! Products primed with ZINOXIDE can be stored outside without danger of rusting!

A midwestern truck body manufacturer* had heard about ZINOXIDE Primer—was intrigued—but wanted to see the proof in his own plant. A Lowe Brothers "Finishing Specialist" demonstrated its amazing qualities of adhesion and durability with impact and conical mandrel tests on a ZINOXIDE primed panel. Then, he put ZINOXIDE to the test on one of the large, hard-to-prime truck bodies—and here's what the manufacturer saw:

- ZINOXIDE flowed out smoothly NO OVERSPRAY, even where it was necessary to double back on corners.
- 2. Dried in minutes—smooth as velvet!
- Required no sanding except for minor touch-up where dirt was on the surface.
- 4. Ready for finish coat immediately—no time and effort spent pulling body out of booth to dry!
- 5. Smooth, beautiful gloss, without "orange peel," was secured in finish coat — proving ZINOXIDE'S excellent "hold out" qualities!

Now, Lowe Brothers ZINOXIDE is at work in this plant everyday—producing better looking results—saving time and money, too, by greatly reducing sanding and handling costs. You'll find that it will be worth your time to check into the possibilities of using ZINOXIDE. Write today for details—no obligation.

THE LOWE BROTHERS COMPANY • Dayton 2, Ohio Industrial Division

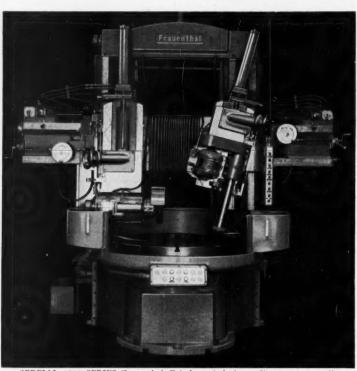
This advertisement is based on facts from Lowe Brothers industrial case history files. LEADERSHIP THROUGH LOWE Brothers
CONSISTENT SERVICE
FINISHES FOR INDUSTRY

GRIND TO MILLIONTHS OF AN INCH PRECISION on Frauenthal GRINDERS

PROBLEM: To assure *related* high-precision uniformity between tapered bores or diameters and flat surfaces.

SOLUTION: Special features were engineered into this Frauenthal Grinder, with one direct-connected spindle (at left) and one cartridge-type spindle (at right) for simultaneous grinding. Photo shows right-hand spindle compound swiveled about 10 degrees off vertical for grinding a tapered bore, while left-hand compound has its motor base swiveled 180 degrees, with axis of grinding spindle parallel to face of table for grinding surface with periphery of wheel.

ACHIEVEMENT: Vital precision (parallelism and concentricity within 200 millionths of an inch!); perfect interchangeability of parts; less production and inspection time; lower costs, greater output!



SPECIAL 1800 SERIES Frauenthal Grinder grinds large diameters or small (1-inch diameter) holes simultaneously, to MILLIONTHS of an inch tolerance!

Great grinding range . . . special high-rail clearance for wide variety of precision work:

Astounding adaptability permits Frauenthal Grinders to do many heretofore "impossible" jobs. For miscellaneous work, unique features of this Special 1800 Series Grinder include: Cartridge spindle (right) with 16" extended quill, 30" overall clear-

ance, speeds up to 10,000 RPM; Direct-connected spindle (left) with two-speed 1800/3600 RPM; pendant-type control for work table and grinding spindles; 180-degree pendant-swing; safety switch (cuts out all power at once) . . . and other features you'll find profitable.

Frauenthal

MULTIPLE-HEAD Grinders

CYLINDRICAL Grinders

PRECISION-GRIND INSIDE OUTSIDE AND FACES
SIMULTANEOUSLY TO MILLIDITHS OF AN INCH!

Similar special features can be engineered into standard Frauenthal Grinders for your specific needs.

write for bulletin

Frauenthal Division

THE KAYDON ENGINEERING CORP.

---MUSKEGON, MICHIGAN-

Production Pointers

GISHOLT



SAVING IDEAS



Presented as a service to machine shops, we hope some of these interesting ideas, culled from thousands of jobs, will suggest ways to help you cut time and costs in your own metal work.

NOW, FOUR TIMES THE SURFACE LIFE FOR THESE MILL ROLLS Yet SUPERFINISH Achieves It In Half the Time

Where you have parts requiring the finest possible surface smoothness, Superfinish saves time and gives you better, longer wearing surfaces. You can bank on it!

Here, Superfinish is at work in the steel industry-finishing mill rolls used for producing stainless steel strip. The machine, a Model 78 Mill Roll Superfinisher handles a variety of these rolls in a fully automatic cycle.

Here's how it saves:

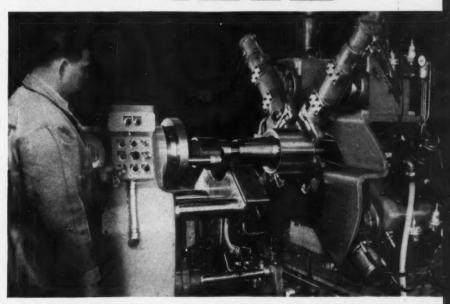
Finishing-Rolls are brought down from 15-20 to 1-2 micro inches RMS by Superfinishing. A roll 36 inches long by 20 inches in diameter requires just 15 minutes to finish . . . less than half the time for grinding.

Longer Life-The Superfinished surface is base metal, not the soft, annealed "smear metal" produced by grinding heat. Experience has proved that this harder, better wearing surface gives the rolls more than four times the service life of those finished by the old method.

Reduced Buffing-The Superfinished rolls leave a much finer surface and the stainless strip requires far less buffing to obtain the desired reflective surface.



Quick-change stoneholder, with two Superfinishing stones, as used on each of four heads.



Superfinisher has fully automatic cycle. After loading, operator merely presses a button; the spindle then drives the roll, and the finishing heads move up to the work and begin oscillating.

These basic advantages of Superfinish-better, longer lasting surfaces that cost less-can be applied to your problems involving cylindrical surfaces. Ask for the reprint, "Mill Roll Superfinisher," which tells the complete story. We will also be glad to send you a free copy of the most authoritative textbook on this modern process, entitled, "Wear and Surface Finish."

Superfinishing gives these mill rolls smoother, longer lasting surfaces, and produces them in less than half the time required by grinding.



Roll surfaces finished to a smoothness of 1-2 micro Inches RMS.



TIME-SAVING IDEAS

IDEAS LIKE THIS CAN INCREASE YOUR PRODUCTION

Many Surfaces
Handled by
Ram Type Lathe
in One Chucking

Careful planning shows up on these first operations for a steam trap head. A Gisholt No. 3 Ram Type Turret Lathe was selected for it because of the many surfaces that can be handled in one chucking.

For fast handling, an air-operated chuck is used. These are the operations: drill D, face F, drill B and C, bottom drill D to stop, and tap D while finish facing F. Time is less than 2.5 minutes, floor-to-floor.

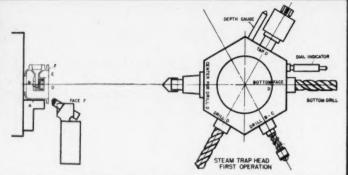
To insure concentricity for B and C, the drill is supported with a bushing in D. Note the indicator to hold the depth of the bottom drill for D. This keeps the depth in perfect relation to face F. Interesting, also, is the depth gauge for D, which assures accurate tapping to the bottom of the hole.

When you plan your setup carefully like this around a fast machine like the No. 3 Ram Type Lathe, you're bound to get low-cost, high production every time.

Here, use of air chuck and combination tooling increases speed, while the indicator and depth gauge insure maximum accuracy.



First drilling operation on steam trup while facing from square turret.



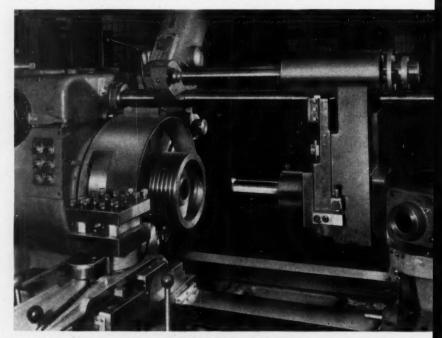
HERE'S HELP FOR SOME OF YOUR TRICKY BORING JOBS ...

Special Unit on Saddle Type Lathe Handles Reverse Tapers or Special Contours

Here's an idea that can make boring operations easier. It's a special taper boring unit, mounted on a 3L Saddle Type Turret Lathe. In this case, conventional taper boring, it makes use of a stub boring bar, a slide tool and a special overhead pilot bar with milled slot holding a cam plate.

It works this way: As the turret carriage feeds forward, a cam follower on the slide tool rides along the cam plate. This guides the tool slide and boring bar along the angle of the cam plate... continuing past the cut before stopping. As the turret is retracted, the boring tool is held away from the finished surface to provide tool relief on the return stroke. When the tool is clear, it is automatically recocked for the next piece.

With this special attachment, fast, accurate bores, tapers and contours can be made without tool marks.



Special taper boring unit on fixed center 3L Saddle Type Turret Lathe



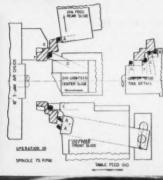
FAST TEAMWORK TO BEAT HIGH COSTS

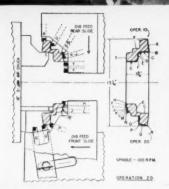
Two Simplimatics and One Man Finish Parts in Jig Time



TIME-SAVING IDEAS









It's simple ideas like this that frequently pay the biggest dividends.

By pairing up two Simplimatic Automatic Lathes with one operator, these bevel drive gears are produced in quick "one-two" sequence.

The first operation takes 5.0 minutes floor-to-floor. Rough and finish cuts on both straight and angular surfaces are done by front and rear slides while five tools on the center slide handle three diameters and two radii at the same time.

Time is 2.5 minutes floor-to-floor for the second operation. The rear slide faces the end, gear flange, chamfers, and rough turns two shoulder diameters. The front slide, operating longitudinally, finish sizes the two shoulders, corner rounds the bore and carries a sliding tool with cam block for rough and finishing the taper O.D.

Easily tooled to combine both straight and angular work of all kinds—the Simplimatic provides fully automatic operation, enabling one man to tend both machines. It's another example of the adaptability of the standard Simplimatics. New catalog shows many examples. Ask for it.

"TURN-ABOUT" GETS RESULTS WITH AWKWARD PARTS

Chuck Holds Tools—The Slide Holds the Work in this Novel No. 12 Hydraulic Lathe Job

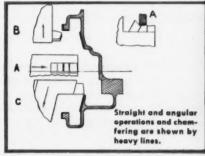
See how good headwork and the No. 12 Hydraulic Automatic Lathe are paying off on this gear case job:

To do the awkward, jumbo-size part the usual way on a conventional turret lathe would have dictated an excessively large machine operating at slow speeds.

However, by turning the job around...and ingeniously mounting the tools on a rotating head and the gear case on a special longitudinal slide, the work feeds to the tools. Boring tools, mounted in a stub bor-

ing bar, do rough and finish boring and chamfering (A). Forward motion of the work-holding slide then stops and tool (B) faces outside surface. At the same time, tool (C) does angular surface—completing job in a single, automatic operation. Floor-to-floor time is just 1.7 minutes.

No. 12 Hydraulic Lathe with rotating tools (instead of work) shows way to real savings in machining time and costs ...and in machine investment and floor space.









HOW TO TURN A HARD JOB INTO AN EASY ONE

Ten Critical Surfaces Machined by Fastermatic... Automatically

TIME-SAVING IDEAS

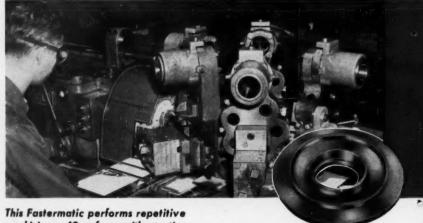
Here's the problem that faced this producer of 7" ball-bearing support rings for our jet

program:

The material is difficult-alloy steel forgings of 40-41 Rockwell C. A large number of cuts are required -10 in all. And, close tolerances must be held.

The combination of a 2F Fastermatic Automatic Turret Lathe and excellent tooling did the trick-with the entire job handled in one chucking.

The drawings show how all six stations of the turret are used. Also, the front and rear independent cross slides. All roughing and finishing operations are completed in 4.5 minutes, floor-to-floor.



machining on 10 surfaces with exacting precision . . . all in one simplified, automatic operation. All the operator does is load and unload.

Fastermatic setup for machining support rings.





























No. 5-653



BALANCING ADDS LIFE TO PSH CRANE MOTORS

Better Service Assured by Machine that Locates, Measures Unbalance

Uninterrupted service is a must with users of overhead cranes. "No serv-

ice" can mean no production. Harnischfeger Corporation, Milwaukee, leading manufacturer of cranes, goes all out to protect its customers...giving vital electrical components added "life insurance" by precision balancing.

The required correction on this 300 lb. rotor assembly is read directly from the meter on the Gisholt Type U DYNETRIC Balancer. With the amount and location of unbalance

determined, a length of solder corresponding to the amount indicated on the machine is metered out and added to the banding wires-while the part is still in the machine.

The results? Increased service life of rotors and armatures, less maintenance, more efficient operation. The Balancer also handles couplings, clutches, fans, etc.

Unbalance in a variety of parts is located, measured and corrected - all without removing parts from machine.

Ask for your copy of "Static and Dynamic Balancing." It has up-to-the-minute facts on balancing.

THE GISHOLT ROUND TABLE represents the collective experience of speclalists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Madison 10, Wisconsin

TURRET LATHES . AUTOMATIC LATHES . SUPERFINISHERS . BALANCERS . SPECIAL MACHINES



eryone Can Count on EDER-ROOT

Aerial navigators and bombardiers rely on the figures that keep turning up on this Veeder-Root Counter, specially designed for the Armed Forces. And if you need to know exactly where you are, with any product or mechanism that's vital to Defense, then you can

count on Veeder-Root to help you, to the utmost limits of ability . . . and of available capacity. Write:

VEEDER-ROOT INCORPORATED "The Name That Counts" HARTFORD 2, CONN.

Chicago 6, Ill. · New York 19 · Greenville, S. C. Montreal 2. Canada . Dundee, Scotland

Offices and agents in principal cities

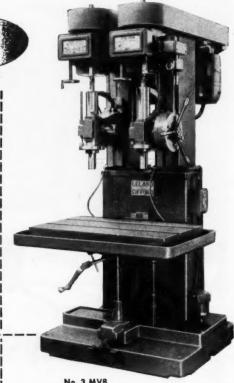


fertile field for cost cutting....

Think of all the HOLES you drill per year

If you want to save money, start where the chances are best... with your drilling operations! Even a slight reduction per hole adds up fast when you think of the holes you drill per year. But these new Leland-Gifford drilling machines will give you much more than a "slight" reduction. They're miles ahead of anything built twenty, ten or even five years ago.

Fast, powerful, rugged yet sensitive, each is capable of handling a wide range of work. All have new features that make for easier operation, faster work handling, greater accuracy and quicker adaptability to changing production requirements.



No. 3 MVB Holes from ¼" to 1½" 24" Swing.1 to 4 Spindles



Holes from 1/16" to 34". 20" or 26" Swing.1 to 6 Spindles

If you drill precision holes, you can't make a more profitable investment than new Leland-Gifford Drilling Machines. Write for complete information.

LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.





Changing personnel in industry creates a never-ending educational need on the subject of files and filing. In the shop-school the logical teacher is usually the shop foreman or production superintendent. The logical textbook is Nicholson's "FILE FILOSOPHY." (And the logical files are Nicholson or Black Diamond!)

"File Filosophy" has become universally accepted as an authority and practical guide in the art of filing. From its 16th edition we quote:

"Mechanical experts and technical students have used it as a foundation for articles in the machinist and industrial press, and for talks to the men in the workshops and classrooms. . . . The numerous editions of 'File Filosophy' have been due both to a heavy popular demand and to a diligent endeavor to keep it up to date — to cover changes in and additions to file designs; improvements in methods and operations; and new developments in materials and products... With modern industrial and machine-shop production calling more and more for specialization in tools as well as in workers — The right file for the job has become increasingly important."

HOW MANY FREE COPIES CAN YOU USE?

"FILE FILOSOPHY" contains 48 informative illustrated pages on the manufacture, kinds, use and care of files. Indispensable to production heads, shop foremen, purchasing agents. How many copies can you use? No charge. No obligation. Write to the address below.



NICHOLSON FILE CO. . 18 ACORN STREET . PROVIDENCE 1, R. I.

(In Canada, Port Hope, Ont.)



NICHOLSON

. . A FILE FOR EVERY PURPOSE

SOLD THROUGH INDUSTRIAL DISTRIBUTORS

millions of parts

Chatter-free turning, smooth feeds, and rigid construction of this LeBlond 16" Heavy Duty Engine Lathe spell precision plus at Linear Incorporated of Philadelphia. Die orientation is insured by turning and boring mating diameters to .0005" tolerances. Flatness of faces is within .001" and roundness of cavity section is held to .001" of perfect circle. Mate-

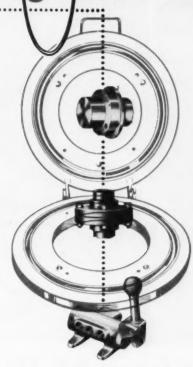
rial: Timken Graphitic MO; tool: high-speed steel.

are married with rings like these

ndustry needs sealing rings to "marry" millions of parts against leakage of air, liquid, and gas. Seals, for example, like the rubber "O" rings made by Linear Incorporated of Philadelphia. They're vital to the successful operation of hydraulic mechanisms, air-operated devices, and chemical processing equipment . . . to name just a few applications. And industry says, "Make these sealing rings to precision tolerance for non-leakage. Deliver the millions we need at low cost."

Linear experimented . . . found that "O" rings with the required finish and roundness could be mass-produced easily enough . . . but to turn them out at low cost demanded virtual elimination of hand-finishing operations. The problem called for dies made to tolerances that would deliver cross-sectional roundness conforming to nearly "perfect circle," mating diameters so accurate that perfect die orientation could be achieved.

Then Linear installed their new 16" LeBlond Heavy Duty Engine Lathe. This profit-building lathe is saving expensive toolroom time and delivering cavity finish on Linear's dies as fine as 10 microinches, mating diameters to the required .0005" whisker of tolerance, cross sectional roundness within .001" of perfect circle. Costly diefinishing time at Linear is down . . . flash-removing second operations on "O" rings are at a bone-bare profitmaking minimum. It's a case of chatter-free turning, smooth-as-silk feeds, and rigid construction.



LeBlond features like hardened and ground self-compensating steel bed ways, totally enclosed quick-change box, one-piece apron and a host of others will insure Linear a lifetime of this same smooth-turning performance.

Whether you need unfaltering accuracy or high output rapid production, there's a LeBlond lathe that will fill the bill. Your nearby LeBlond distributor will tell you about our complete line. Call him or write

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

Ask for Bulletin HD125 D for more information on the 16" LeBlond Heavy Duty Engine Lathe

turned faster by





Gorton Contour Mill, CM-12, Produces Extreme Accuracy and High-Surface Finish with Minimum Maintenance

This machine produces highly accurate, identical pieces — complicated cam shapes, external or internal, or continuous grooves and slots of irregular radii. The Gorton Contour Mill is easy to use and versatile — a simple tracer-controlled, vertical-head milling machine with two rotary power-driven tables. No complicated electronic, hydraulic or pneumatic controls.

CAPACITY ...

Wide spindle-speed range — 300 rpm to 10,000 rpm — for either high-speed steel or carbide cutters, burrs or grit grinding wheels. The 16-inch master-copy table easily accommodates larger master cams. Several thin cams can be stacked and profiled at once.

EXTREME ACCURACY...

Operation depends upon a heavy, singlepivot beam which provides more accuracy than can be built into the tooling. A choice of several reduction ratios adds to accuracy and provides low micro-inch finishes. The reduction ratio principle produces piece parts to closer tolerances than those of the master.

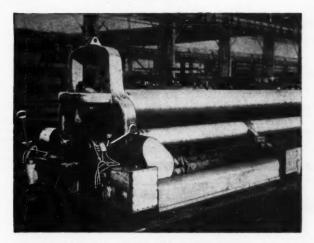
CUSTOM-DESIGNED . . .

The basic machine is standard, but each mill is tooled for specific work. Because all machine elements are individually motor-driven, the machine can be adapted to a wide range of applications. Write for complete details and your copy of Special Bulletin 2380-C-1305.

GEORGE GORTON MACHINE CO.

1305 RACINE STREET . RACINE, WISCONSIN, U.S.A.

FARVAL-Studies in Centralized Lubrication No. 140



KEYS TO ADEQUATE LUBRICATION—Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

FARVAL SAVES ON BENDING ROLL LUBRICATION

	Lbs./yr. lube. 62 points	Hrs./yr. lube. 62 points	Annual Cost @ \$1.50/hr. 62 points		
GREASE GUN CENTRALIZED SYSTEM	20,592 lbs.	717 hrs.	\$1,075.00		
	5,304 lbs.	15 hrs.	\$ 22.50		
ANNUAL SAVINGS EFFECTED BY FARVAL	15,288 lbs.	702 hrs.	\$1,051.50		
COMBINED SAVING (LABOR AND LUBRICANT)			\$2,579.50		

AND IN ADDITION, FARVAL SAVES
BEARING EXPENSE AND PRODUCTION TIME

Reports of lubrication engineers show lubrication by grease gun takes .747 minutes per point—to clean dirt from nipples, grease, move from point to point, and refill gun. With Farval it takes only 15 minutes every fourth day to refill Farval reservoir. In addition, Farval saves 3 pounds of each 4 of lubricant used by other methods.

800 miles of pipe rolled on Baldwin Bending Roll lubricated by Farval

HIS first of a new type bending roll formed over 800 miles of 24" and 30" O.D. pipe its first operating year. At work in a large southern pipe mill, it shapes 31½ foot lengths of 78" and 97" skelp at rolling speeds up to 60 feet per minute.

To insure that the new design features for increased production would not be hamstrung by old-fashioned hand lubrication, the machine builder equipped the bending roll with Farval centralized lubrication.

At a single stroke Farval lubricates 62 main bearings on which depends the rugged job of shaping skelp. No stopping for time-consuming hand oiling! Lubricant savings run as high as 75%.

Farval is the original Dualine system of centralized lubrication that delivers oil or grease under pressure to a group of bearings from one central station, in exact quantities, as often as desired. The Farval valve has only two moving parts—is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble. Indicators at every bearing tell that each valve has functioned.

Machinery builders and customers alike recognize that Farval centralized systems of lubrication save time, money and lubricant, as well as eliminate bearing expense and increase machine production.

There are Farval systems for your machines, big or small, with proportionate savings. And there's a Farval engineer near you, ready to solve your lubrication problems. Write for full details. Send for Bulletin 25 today. The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.



Cost per Cut that Counts

Study these high production, low cost figures on three Motch & Merryweather Circular Sawing Machines

Make your own study of the cost per cut in your metal-sawing department. Then find out from Motch & Merryweather how much production at lower cost you can get on M. & M. Circular Sawing Machines, using our Triple-Chip blades.



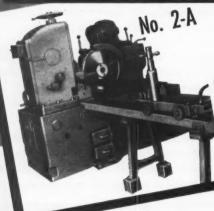
Operation: Steel door frames (mitre cut).

Rolled steel shapes 6" wide x 1/16" thick.

Production: 200 pieces per hour. Tool cost per piece: \$.0002.

M. & M. No. 00-G Circular Sawing Machine. Manual or automatic stock feed. Readily adaptable to making cuts at angles up to 45° as well as high production square cut-off. Capacity: up to 3" diameter round; shapes - up to 3-3/8" x 6".





Operation: Rocket nozzle stock cut to length.

Material:
Production: 60 pieces per hour The No. 2-A machine pictured at the left has automatic Mareria: 5. A. E. 1020, 5 ala Production: 60 pieces per hour. Tool cost per piece: \$.001.

Ine No. Z-A machine pictured at the left has automatic stock feed up to 72" cut-off lengths. It is offered also with manual stock feed. Capacity: up to 6-1/2" diameter round; structural shapes—up to 5" x 12".



Operation: Forging billets cut to length. Material: S. A. E. 1045, 14" square. Production: 6 pieces per hour.

Tool cost per piece: \$.12.

No. 4. Widely used in steel and structural steel plants and forge plants sawing all types of forging, stainless and titanium alloys, die block steel, etc. Capacity: to 17" dia. round; structural shapes up to 24" I-beam.



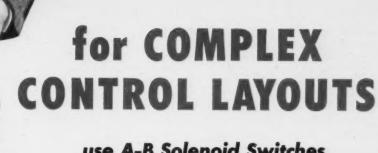
Complete size range, ferrous or non-ferrous, up to 43" diameter.

Manufactured by

Builders Also of Production Milling, Vertical Turning, Automatic and Special Machines

PRODUCTION-WITH-ACCURACY MACHINES AND EQUIPMENT



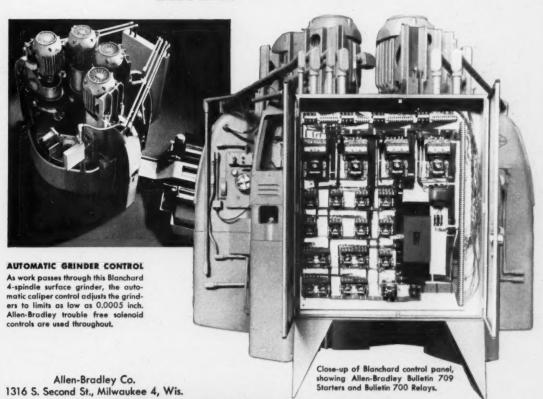


use A-B Solenoid Switches
...they are SIMPLE • COMPACT • TROUBLE FREE

OVERLOAD PROTECTION

Accurate thermal relays protect the motor against sustained overloads. Their accuracy and dependability are not affected by long inactivity. Be safe with Allen-Bradley starters. ♠ Allen-Bradley pioneered the development of the SIMPLEST... and therefore the MOST RELIABLE... starting switch in the world. It is the Bulletin 709 Solenoid Starter... the switch with only ONE moving part. There are no troublemaking gadgets like pins, pivots, bearings, or jumpers. And it is exceedingly compact, which permits close groupings on control panels.

Machine tool builders use Allen-Bradley solenoid starters and relays for their control panels, because they are consistent in action and so trouble free. Follow their example, and standardize on Allen-Bradley solenoid controls.



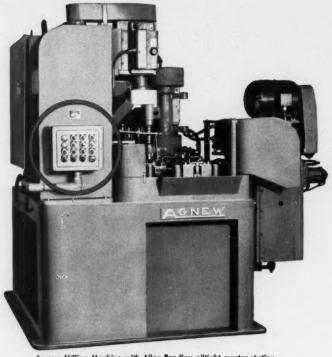
SOLENOID MOTOR CONTROL



BULLETIN 800T OILTIGHT STATIONS for concentrating control where most convenient

The 15-button control station, shown below, is a typical oiltight master station equipped with Allen-Bradley push buttons. Any combination of standard buttons can be assembled in these stations. Over 40 name plate designations are available.





Agnew Milling Machine with Allen-Bradley oiltight master station.

BULLETIN SOOT PUSH BUTTONS



CONTACT BLOCKS-OPERATORS

Allen-Bradley Bulletin 800T Push Buttons consist of two parts —the contact block in several different contact combinations, and the operator furnished with various types of buttons. These units may be assembled in a large variety of combinations to fit any special requirement.

OILTIGHT PUSH BUTTONS for Machine Tool Applications

Oils, cutting fluids, and grease cannot penetrate the double synthetic rubber seals between the push button operators and the contact mechanisms of Allen-Bradley Bulletin 800T Push Buttons. Consequently, long, trouble free operation can be guaranteed.

Bulletin 800T Push Buttons come in many handy forms, such as with momentary or maintained contact push buttons, 2 and 3 position selector switches, jogging buttons, etc. All push buttons have double break, silver contacts, and terminals are equipped with shakeproof wire clamps. Name plates can be provided for special, as well as standard, designations.

Independent pilot lights or stations with pilot lights can be furnished in various colors. Send for Bulletin 800T.





To procure gears that would meet the most exacting specifications of quality materials and precision cutting and finishing required for this new artillery piece, the U. S. Army came to Philadelphia. With our many years of specialized gear manufacturing experience plus our modern equipment we filled that need. We are proud of our part in producing for America this first ground weapon capable of firing conventional and atomic shells.

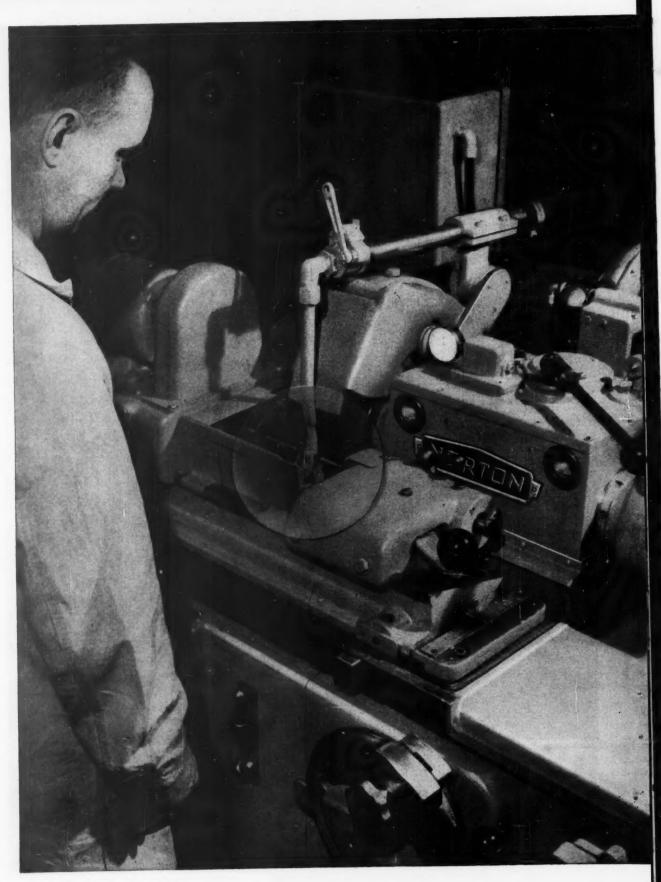
FOR DEFENSE AND INDUSTRY Gears **Speed Reducers** LimiTorque **Valve Controls**

adelphia Gear

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK . PITTSBURGH . CHICAGO . HOUSTON . LYNCHBURG, VA.

Industrial Gears and Speed Reducers LimiTorque Valve Controls



46-Machinery, May, 1953

SMALL PARTS PAY OFF BIG... WITH THIS

"TOUCH OF GOLD"

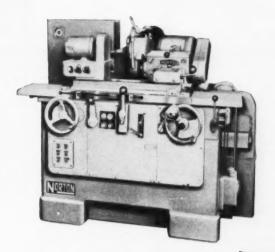
The new Norton

4" type CTU

Cylindrical Grinder

gives you high precision

plus high production



Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations — in 12" or 18" work length capacities in both models.

Either way you'll get the added "Touch of Gold" by faster, more accurate, more profitable grinding of a wide variety of small parts. Because either way the 4" Type CTU's Norton-developed features bring a new ease of operation for your men—and a new high in production quality and quantity for you.

To name just one of these advanced features, there's the extremely rugged wheel spindle unit that assures enduring precision in jobs ranging from heavy stock removal to fine finishing. But why not get the whole story of this speedy, profit-boosting grinder from your Norton Representative?

Write for Catalog No. 531. And remember: only Norton

offers you such long experience in both grinding wheels and machines your assurance of the value-adding "Touch of Gold" that means better products at lower cost. NORTON COM-PANY, Worcester 6, Mass.



To Economize Modernize With NEW



GRINDERS and LAPPERS

Making better products to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit • In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5, Ontario

YOU GET SPEED
PLUS ACCURACY

WITH MOORE JIG GRINDERS



HOLES from 1/64" to 8" Relocated and Ground within .0001" in One-Third Previous Time

Before hardening, this two-station die block was Moore-Jig-Bored to eliminate the need for excessive grinding. After hardening and surface grinding, all holes were Moore-Jig-Ground to exact size and location. Blank hole and center piercing hole were ground with ½° included taper. Little clearance could be allowed between punch and die. Jig grinding time: only 2¼ hours.



CONTOURS, Too, Accurately Jig Ground and Checked in One Setting

This flanged punch, impractical to grind by any other method, was a natural for the No. 2 Moore Jig Grinder. All radii—male and female—were ground accurately to location and size. The piece, having been set up on a rotary table, was aligned to permit grinding of the angular surfaces. And the entire contour was inspected by the "indicator measuring" method while the punch was still on the machine.

The word "versatile" must have been coined for the No. 2 Moore Jig Grinder. Not only does this machine relocate and grind straight and tapered holes with ease, but it contour grinds, chop grinds and slot grinds just as skillfully.

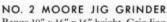
The Moore Jig Grinder, together with its toolroom teammate, the Moore Jig Borer, enables tool and die sections to be produced concurrently, puts diemaking on an interchangeable-parts-and-assembly basis. And it's also a time-saver on production jobs.

Employing the accurate lead screw measuring principle and a convenient system of coordinate hole location, the fast and sure Moore Jig Grinder eliminates hours of checking on bench and surface plate.

Why not find out how this remarkable machine can save *you* sizeable chunks of time and money. Write today for our detailed bulletin.

MOORE SPECIAL TOOL COMPANY, INC.

734 Union Ave., Bridgeport 7, Conn.



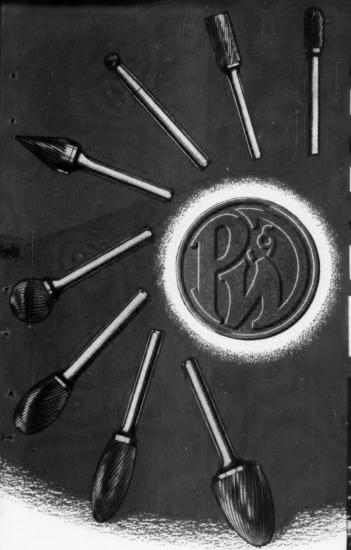
Range 10" x 16" x 16" height. Grinding speeds from 12,000 to 60,000 rpm. Infinite feeds up and down; spindle-housing heat control. Features slot grinding attachment.

ADD CTOOL TO YOUR TOOLROOM

JIG BORERS - JIG GRINDERS - PANTO-CRUSH WHEEL DRESSERS - DIE FLIPPERS - MOTORIZED CENTERS - HOLE LOCATION ACCESSORIES

MACHINE TOOL CATALOGS

48-MACHINERY, May, 1953



DIFFERENT JOBS

DONE

BETTER and FASTER

KELLERFLEX BURS



USED ON KELLERFLEX
FLEXIBLE SHAFT MACHINES . .

... like the Series M shown above, you have smoothness, ample power and speed range to obtain maximum performance from Kellerflex Burs. Smaller and larger models are also available. Write on your Company letterhead to the Pratt & Whitney Branch Office nearest you—or direct to West Hartford. Ask for Circular No. 521-2 on the "Series M" Machine.

Precision in every respect, Pratt & Whitney Kellerflex Burs give more efficiency . . . cut faster, smoother, longer than any other cutting tool of this type. Here are some reasons why:

CORRECT DESIGN — Rake angle, flute helix, spacing are right for your jobs because P&W leads in scientific Bur Engineering.

FINE MATERIALS — Correct grade of carbide and expertly heat-treated high speed steel, mean keen cutting edges and longer cutting life.

MASTER-GRINDING by MACHINE — From hardened solid blanks was originated by Pratt & Whitney to assure complete concentricity, uniform flute spacing and form, and superior balance so essential to smooth cutting without chatter or bounce. No hand-ground bur can match this performance. At P&W, "machine-grinding" means "100% by machine" — human error is eliminated.

EXACT DUPLICATES — All P&W Burs of the same size and shape (there are 14 standard shapes plus dozens of specials) are exactly alike. You can order replacements by number and always get identical performance.

GET COMPLETE, MONEY-SAVING INFORMATION NOW. Write on your Company letterhead to the Pratt & Whitney Branch Office nearest you — or direct to West Hartford. Ask for the new P&W Kellerflex Bur Catalog.

PRATT & WHITNEY

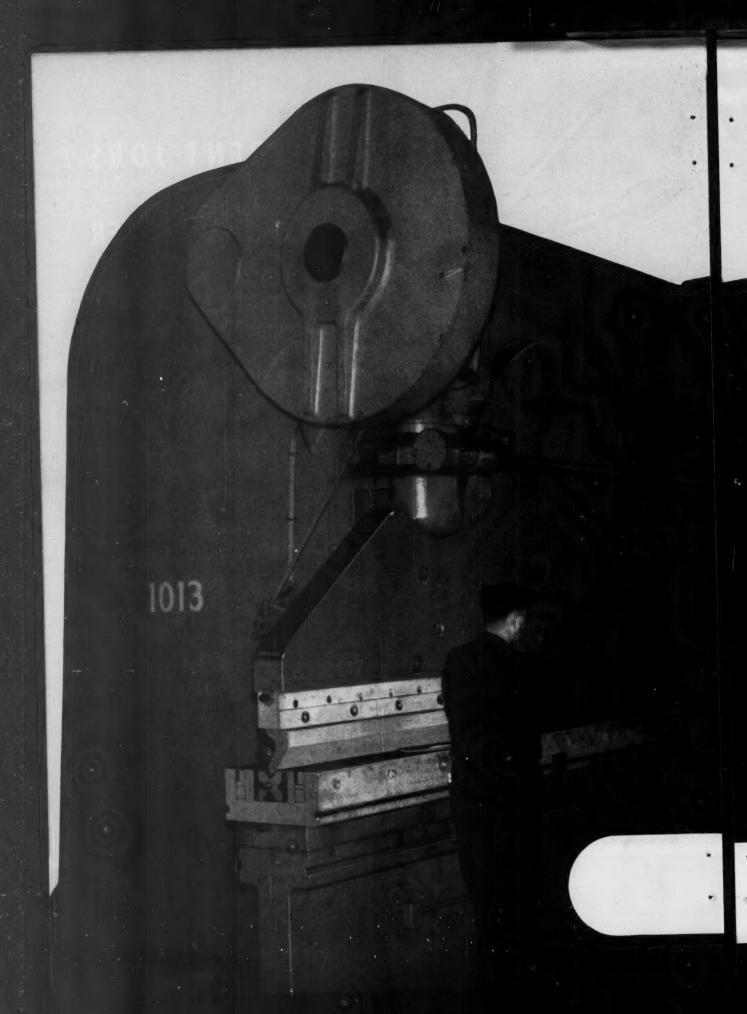
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U.S.A.



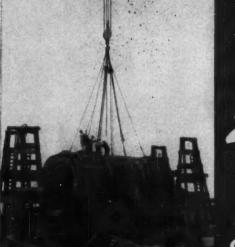


Brench Office ... EIRMINGNAM . BOSTON . CHICAGO . CINCINNATI . CLEVELAND . DALLAS (The Brance Co.) . DETROIT . HOUSTON (The Stance Co.)

MACHINE TOOLS • CUTTING TOOLS • GAGES



Here- a Cincinnati Press Brake saves 3 ways...



- 1. TIME
- 2. NUMBER OF **OPERATIONS**
- 3. MATERIAL

Built at The Maryland Drydock Company these giant condensers for the Westinghouse Electric Corporation are some of the largest ever constructed.

Photographs courtesy of The Maryland Drydock Company, Baltimore, Maryland

Crimping plate up to 3" thicknesses has cut roll-forming time in half at The Maryland Drydock Company.

The press brake crimps the ends of the plates with special dies, and has eliminated both the costly burning operation, and the loss of 15" to 18" of the ends of the plates.

Some of the large radius bends are done entirely on the Cincinnati Press Brake.

Write for the NEW 72-page Press Brake Catalog B-4.

HE CINCINNATI SHAPER

CINCINNATI 25, OHIO, U.S.A.

SHAPERS . SHEARS . BRAKES



RONG TOOL HOLDERS Militaria ARM STRONG TUNGSTEN CARBIDE PATO TOOLHOLDER **Equip** with

Equip with
ARMSTRONG TOOL HOLDERS
for Defense production

A change over to new products, starts in the tool room and the die shop . . . starts with ARMSTRONG TOOL HOLDERS. In preparing for defense orders, the logical first step is to check your stock of ARMSTRONG TOOL HOLDERS. With the correct types for every operation, and the correct sizes for each lathe, planer, slotter and shaper, you will be able to start work on a moments notice.

ARMSTRONG TOOL HOLDERS reduce "tooling-up" to the selection of a cutter and tightening of a set screw. They permit oper-

ation at higher speeds, and heavier feeds than are customary—they enable you to produce more pieces per hour, per man, per machine.

more pieces per hour, per man, per machine.
Produced by modern methods, in a specially-built tool plant, they are the lowest cost tooling you can buy. And, they are as available as your telephone for they are carried in stock by your local supply house.

use ARMSTRONG TOOL HOLDERS wherever possible for lower tool cost, saving in High Speed Steel, increased output and greater profit. Write for Catalog



ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"
5213 W. ARMSTRONG AVENUE CHICAGO 30 ILL



A Sportsman's Paradise - Sun Valley, Idaho

Wide World Photo

The
Invisible
Background
of
Industrial
Progress

Sun Valley, Idaho, where this awe-inspiring view was taken, offers more than 27 different sports to the thousands of people who visit it each year. Eight mechanically operated chair lifts carry guests to the four surrounding mountains. The highest of these, Baldy Mountain, reaches a total of 3,200 feet above the valley floor. Here a breath-taking panorama of the area unfolds. In some of the mountain areas the chair lifts provide the only means of transporting material, food and supplies as well as the guests to the summit.

Many beauty spots are now being enjoyed more than ever since they have been made accessible by modern transportation facilities.

* As manufacturers of *Modern Machine Tools*, The Bullard Company is proud of its part in the research, engineering and development of accurate, rugged, dependable, versatile, and economically operated machines that have helped build and maintain the American transportation system.

* For greater manufacturing economy REFER to next page

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

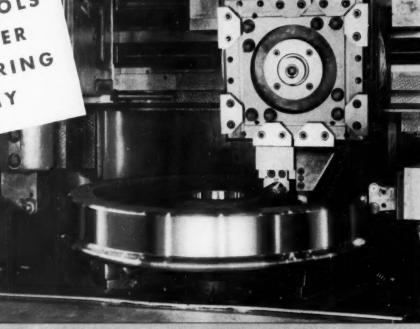
BULLARD

MACHINE TOOLS

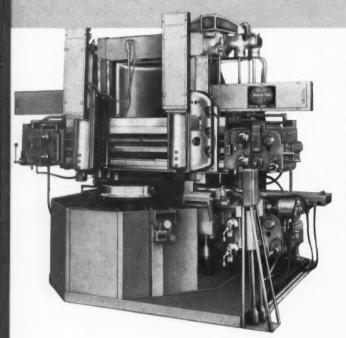
FOR GREATER

MANUFACTURING

ECONOMY



Bullard Man-Au-Trol Car Wheel Lathe on production of Diesel Locomotive Wheels. One of many now installed for the production of Railroad Locomotive and Car Wheels.



Man-Au-Trol with manual or automatic control has taken the guess work out of the previous manual operations on highly accurate repetitive work.

Automatic change of feeds and speeds at the proper instant, automatic change of direction of feed, automatic precision index of heads for succeeding operations, automatic operation of the heads through their entire cycle of operation, all contribute to the productive efficiency and minimum operator fatigue, at a pace previously unobtainable with single spindle machines of the size and capacity of Man-Au-Trol.



Complete information on request.

TOUGH STUFF

Axelson lathes make your tough jobs easier, delivering constant precision work, even under the most difficult operating conditions. This chip, a sample of the rugged cuts Axelson lathes can make, is from a ship shaft of #6140 chrome vanadium alloy steel 16" in diameter. Cut was made at 25 s.f.m., feeding at .240 per revolution; depth of cut 1". Tough stuff? Sure, but it's easy when you use an Axelson lathe.

Chosen first to last AXELSON

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

TOOL ROOM LATTICE . CAPTAIN LATTICE . HE MAY BE TALKED LATTICE

AXELSON MANUFACTURING CUMPANY - Division of Pressed Steel Car Company, Inc.

Los Angeles 58 - New Tork 7 - St. Louis 16

"Authorized Distributors in All Principal Industrial Centers WRITE FOR AXELSON LATHE BULLETIN #5001

3 in 1 machine tool

combines vertical milling, downfeed milling and jig boring

now available for prompt delivery...

In one <u>set-up</u> of the work, the HURTH Precision Boring and Milling Machine performs <u>three</u> different machining operations to close tolerances—you merely change table settings and cutting tools for—`

VERTICAL MILLING—using the longitudinal traverse of the worktable, which can be tilted 15° to front or rear.

DOWNFEED MILLING — using the longitudinal traverse of the worktable and graduated downfeed of the cutting spindle.

JIG BORING—using the continuous spindle downfeed, which can be varied in extremely small steps.

Specifically designed for precision machining of jigs, fixtures, molds, dies, gages and similar close-limit tooling, the HURTH is equally adaptable for small-lot and long-run production work.

13 spindle speeds cover the range from 45 to 2,800 rpm. 9 boring speeds are available for each of the spindle speeds. Precision cutting is assured by the extremely long spindle quilt guided in a precision-bored hole, with a double-row roller bearing in the spindle head maintaining a true running spindle. The rugged construction of the machine virtually eliminates distortion under load.

Gage block measuring equipment on the worktable enables operator to accurately check the work while it remains in position in the machine.

The HURTH 3-in-1 machine will cut costs as fast as it cuts chips...in your toolroom or on your production line. Write for literature and complete specifications.



HURTH V 10a—Boring and Milling Machine with 193/4" swivel table in position on worktable. Worktable area is 113/4" x 391/4".

Engineered servicing from Orban Service Centers in Cleveland, Detroit, Newark. Stock parts from Cleveland.



MACHINING A BULKY WORKPIECE held on the tilting table. Note deep throat of machine.



BORING AND FACING operations, using a baring and facing head.



DRILLING holes for drill jig



JIG BORING holes, previously drilled in the HURTH machine.



URT ORBAN

COMPANY, INC. 105 East 42nd St., New York 17 • 4220 Prespect Ave., Cleveland 3 • 19450 James Couzens Highway, Detroit 35 1939 Santa Fe Ave., Los Angeles

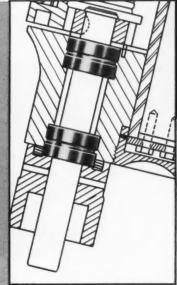
TILTED BEATER SHAFT provides new mixing principle in "Triumph" Vertical Mixer

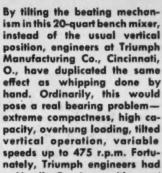
Unusual bearing requirements met by

ORANGE

Cage Type

NEEDLE BEARINGS





been using Orange Cage Type Needle Bearings with great success on other vertical shafts in its line of beaters. Would they work on the tilted shaft? Yes! After long testing and field experience, equally fine performance is being obtained in the new tilted beater mixers.



e Available in stock sizes from ½" to 8"
shaft diameters, fully interchangeable with
standard heavy-duty needle
bearings. Write for Engineering
Date Book.

Rangi

Permanent alignment of rollers prevents skewing

With all rollers guided by retaining pockets of the anti-friction cage, Orange Cage Type Needle Bearings are true running in any position—vertical, tilted, horizontal. They work equally well in overhung applications and are less affected by misaligned mounting or uneven loading. Internal clearances can be accurately controlled for exacting requirements.

As a result, Orange Cage Type Needle Bearings—originators of this type bearing—are enabling design engineers to gain the many advantages of needle bearings in applications heretofore unsuited for conventional types. Operation is extremely smooth and quiet, with longer life expectancy. All rollers and races are "Pentrate" finished for resistance to corrosion.

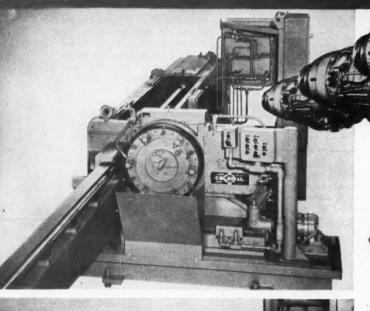
ORANGE ROLLER BEARING CO., INC., 552 Main Street, Orange, N. J.



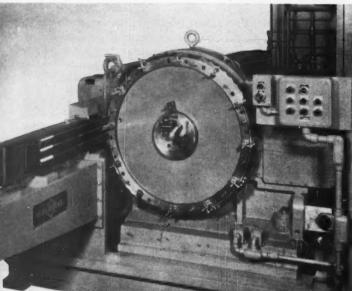
COLONIAL broaching machine, 10-ton 90-inch stroke horizontal, with trunnion fixture for angular adjustment. Shuttling, indexing, ram operation, and rapid return fully automatic, for broaching internal slots on Curtiss-Wright SAPPHIRE ring segments. Pneumatic part ejection manual control.

COLONIALS

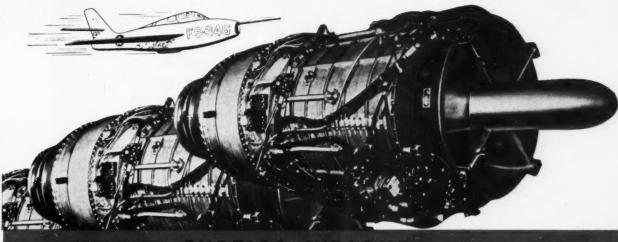
MEAN



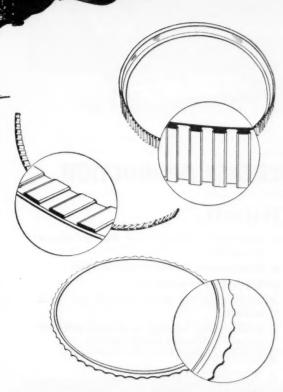
Another fully automatic COLONIAL 10-ton 90-inch stroke horizontal broaching machine broaches external slots on a SAPPHIRE jet engine part. Again, shuttling, indexing and ram operation are automatic, and part ejection is pneumatic manual control.



Three external scallops on this Curtiss-Wright SAPPHIRE part are broached automatically with each stroke of the ram, on this 10-ton 60-inch stroke COLONIAL broaching machine. Like the other machines shown, electrical controls permit individual operation of each function for set-up and tryout purposes.



MORE SAPPHIRES in the Air



These drawings, distorted for security reasons, indicate the types of jet engine parts being produced automatically today on COLONIAL broaching machines with 'unified' broaching. COLONIAL BROACH is proud to be a supplier of broaching machines to the Curtiss-Wright Sapphire jet engine program. This 25% more powerful jet fighter engine has gone into production in record breaking time, and record breaking production will be possible due to the high production accuracy of machine tools like the fleet of automatic Colonial broaching machines, complete with Colonial broaches and fixtures, working on this program.

"Always ready for flight" is the reputation established by SAPPHIRES at the Air Force's principal flight test base. "Always ready for broaching" is the reputation established by COLONIALS in leading production shops of America. This reputation can be traced to Colonial's 'unified' broaching, made possible by designing and producing the broaching machine, the broaches, the fixtures, and the automation, all in Colonial's own plant, and all serviced by Colonial in the production shop.







Redesigned just in time to meet the needs of increased production in your

plant, this ACME Model XWT eight spindle nut tapper will not only step up production but because of semi-automatic operation, will greatly reduce operator fatigue. Built in 6 and 8 spindle models in 1" and 2" capacities. The same machine can also be adapted for tapping couplings. Delivery schedules are reasonable.

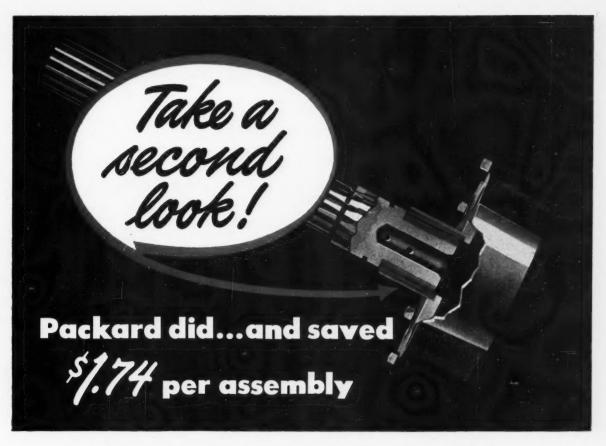
FEATURES

- 1 Conveniently located push buttons operate the spindles.
- 2 Hydraulically controlled spindle cycle.
- 3 Repeat cycle is automatic.
- 4 Adjustments for change of cycle are quick and easy.
- 5 Change gears running in oil bath easily replaced for different spindle speeds.
- 6 Silent operation.
- 7 Worm drive in spindles.
- 8 Anti-friction bearings.

THE HILL ACME COMPANY

ACME MACHINERY DIVISION . 1203 W. 65th St., Cleveland 2, Ohio

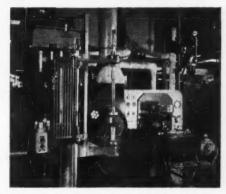
"ACME" FORGING . THREADING . TAPPING MACHINES . ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES MYDRAULIC SUPFACE GRINDERS . "CANTON" ALLIEATOR SHEARS . PORTABLE FLOOR CRANES . "CLEVELAND" KNIVES . SHEAR PLACES



with TOCCO* Induction Brazing

THIS is the "planetary output shaft" for the Packard Ultramatic Transmission. It was originally designed to be made from a forging, but Packard engineers "took a second look" and determined that a slight design change, using a casting and a steel shaft, permitted taking advantage of Induction Brazing. This resulted in a savings of \$74,325 in the equipment and tooling for production, in addition to the actual labor and materials savings of \$1.74 per assembly.

When designing your new product, or redesigning present products for more economical manufacture, you will profit by considering TOCCO Induction Heating for brazing, hardening, soldering, forging or shrink-fitting. Designing for Induction Heating pays off!



A 30 KW, 10,000 Cycle TOCCO Unit Brazes 45 Assemblies per hr.

THE OHIO CRANKSHAFT COMPANY

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BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-5, Cleveland 1, Ohio
Please send copy of "Design and
Manufacture for Profit"

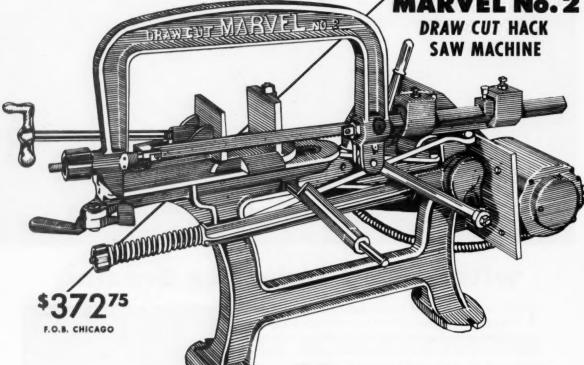
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For... General-Purpose Sawing

General-Purpose Sawing

Capacity up to 8" round

Improved RVEL No. 2



See your Dealer. If he does not stock MARVEL Saws, he can get them quickly. Or simply write us for literature and delivery. When buying hack saw blades insist that your dealer furnishes genuine MARVEL High-Speed-Edge Hack Saw Blades—they are unbreakable! are unbreakable!

Fast... because the simple, rugged construction permits the use of high speed steel blades.

Accurate . . . because the improved Saw Frame with clamping type blade holders holds the blade in perfect alignment and proper tension.

Economical ... because of its automatic relief on the return stroke, the blade will last and last and last.

Dry Cutting... because modern high speed steel blades will operate efficiently at 60 strokes per minute without a coolant.



ARMSTRONG-BLUM MFG. CO. · 5700 Bloomingdale Ave. · CHICAGO 39, ILL.





IT'S SOLID .. ADJUSTABLE .. COMPACT!

Whenever you need an adjusting tap, but can't use a collapsing tap...especially where tooling space is limited and fast withdrawal not necessary...you'll find the GEOMETRIC Class SJ Solid Adjustable Tap ideal. This short, stubby tap will give you the advantages of fast adjustment to required decimal sizes or different class of thread and may be used for more than one pitch by the use of interchangeable chasers!

Class SJ taps available in eleven sizes covering the cutting range 15/16" through 81/2".

Write for full details. Specify Bulletin SJ

Greenfield Tap and Die Corporation

DEGMETRIC TOOL COMPANY DIVISION
NEW HAVEN 15, CONNECTICUT



1 SET

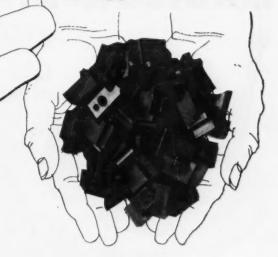
cuts more threads...

of ground thread circular chasers

than 10 SETS

of radial hobbed and lapped chasers





another reason why so many production shops standardize on

VERS-O-TOOL

with GROUND THREAD CIRCULAR CHASERS

With circular ground thread chasers, you grind 200 times and up-to a full 270° of their circumference; with radial type you average 4 grinds.

With circulars, you vary the grind with the right hook and clearance to suit any material; with radials your grind is fixed, usually limited to one material, one job.

With the circular chaser Vers-o-tool System you use the patented Micrometer gauge-every regrind is identical, insuring precise uniformity of threads. You avoid adjustments, scrap loss and save time-reduce your chaser costs 10 to 1 or better, over radial chasers.

Ask for Catalog DT-52

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines . Automatic Threading Dies and Taps . Limit, Motor Starter and Control Station Switches . Solenoids . Contract Manufacturing

CHALLENGE TO OBSOLESCENCE

By the time you've used up two sets of circulars you will have saved enough to pay for the entire Vers-o-tool installation.

The difference in life and in performance between ground thread circular chasers and the old conventional type as proved in shop after shop enables us to make this guarantee.

24-hour deliveries on most standard stockable NC and NF chasers and blocks—also National taper pipe and dry seal.



Style DS Vers-o-tool (Non-revolving Type)
10 Sizes, 3/8" -61/2".

Style DR Vers-o-tool (Revolving Type)
13 Sizes 3/4"-61/2"



Style DBS Vers-o-tool (for B&S Automatics) 3 Sizes, 1/4"-1/4" Ground thread circular chasers and their holding blacks are interchangeable, die size for die size, among all styles of Vers-a-tool automatic heads.

DESIGNING

for the home-workers

with

MADISON-KIPP

ZINC AND ALUMINUM
DIE CASTINGS



The majority of Americans have two important jobs—one to make a living and another to make living more enjoyable around their homes.

The home-worker is a selective buyer. He understands value. He is quick to recognize improvements in product design. That's why the Flour City Brush Co. of Minneapolis selected Madison-Kipp Die castings for their Autowash Brush. They add the magic touch that increases sales.

Perhaps you should use more die castings in your own products. Please write to our home office in Madison, Wisconsin.

MADISON-KIPP CORPORATION

203 WAUBESA STREET • MADISON 10, WISCONSIN

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Skilled in Die Casting Mechanics
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 Originators of Really High Speed Air Tools

66-MACHINERY, May, 1953

II MODELS

3 SCREEN SIZES



Pedestal Type 14" Diam. Screen



Bench Type 14" Diam. Screen 4 Models



Bench Type 5%" x 7%" Screen 3 Models

Unsurpassed Inspection Versatility JONES & LAMSON OPTICAL COMPARATORS The Essence of Quality Control

Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

- They meet the requirements of toolroom, laboratory and production inspection.
- They precisely measure height, depth, lead or spacing, as well as angles to degrees and minutes.
 They will measure to .0001".
 - They compare intricately contoured parts with a master outline—and measure the amount of error.
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 - They will photograph the enlarged shadow and record its relationship to a master chart.
 - Several persons may study the shadow at the same time.
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Vertical Type 14" Diam. Screen



Direct Projection Type



Pedestal Type 30" Diam. Screen



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JONES & LAMSON

512 Clinton St., Springfield, Vt., U.S.A.



Machine Tool Craftsmen Since 1835

COMPARATOR DIV.



Jones & Lamson Machine Company 512 Clinton Street, Dept. 710 Springfield, Vermont, U. S. A. Please und Comparator Catalog No. 402.

NAME_____TITLE_____
COMPANY_____

STREET



A product for EVERY

Your Widest Choice of Abrasives for Every Operation

PRODUCTS	SNAGGING OF ROUGH GRINDIN	I DED	URRI:16	WELD		SMOOTHII EDGES	161	and POLISHING	GRI	IIE NDING
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...from CARBO

"Carborundum," "MX" and "Port-A-Belt" are trademarks of The Carborundum Company, Niagara Falls, N. Y.

PORTABLE GRINDING job



Deburring with slotted discs. You can choose the deburring method best for you from at least 7 abrasive products by CARBORUNDUM.



Weld clean-up with rubber-bushed straight wheel by CARBORUNDUM...one of 8 ways you can grind welds with portable equipment.



Rough grinding with straight wheel. This job could also be done economically with abrasive belts and the Port-A-Belt grinding attachment by CARBORUNDUM.

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CALL YOUR CARBORUNDUM DISTRIBUTOR TODAY. He offers experienced counsel, complete stocks, prompt delivery.

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Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

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BLANCHARD

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BLANCHARD SURFACE GRINDERS . BLANCHARD GRINDING WHEELS

He deserves - and will appreciate - your friendly attention. Perhaps

he's coming in your door right now . . .

BORING and TURNING MILLS

BETTS

BUILT IN SIZES FROM 100" UP TO ANY REQUIREMENT

For full details on 100" Mill send for Bulletin No. 2129

Among Heavy Machine
Tools built by
Consolidated are

LATHES
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SPECIAL MACHINES

BETTS 100" HEAVY DUTY BORING AND TURNING MILL

As in other Betts Boring and Turning Mills, this 100" mill is designed to provide a rugged, simplified general purpose tool that successfully combines accuracy, speed and power. Its features, many of which are exclusive, all contribute to this machine's reputation for outstanding performance; its production speed and accuracy, long operating life, safety of operation, convenience of control and all-around dependability under exacting operating conditions.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

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SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

ROCHESTER, NEW YORK

Now... Longer Gage Life

... WITH TAFT-PEIRCE Electrolized GAGES

Experience proves that these electrolized Taft-Peirce Gages give many times longer life than ordinary hardened steel gages.

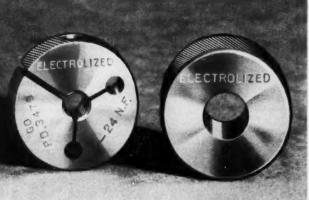
An even film of hard, non-magnetic alloy — only .000025" thick — on all gaging surfaces provides exceptional wear-resistance.

Extremely smooth, this film has a very low co-efficient of friction, with high resistance to corrosion. Extremely tough, it won't chip, peel, or spall.

Electrolizing can be applied to standard or special gages and to CompAIRator Air Gage members. Accuracy is held to the same high standards as found in all Taft-Peirce gages. For more details, write today.

THE TAFT-PEIRCE MANUFACTURING CO.









Corrosion won't hurt this TRI CLAD motor's cast-iron frame

HERE'S A COMMON SIGHT AROUND MANY PLANTS-

A G-E Tri-Clad motor operating reliably and continuously under the extremely corrosive conditions that cause many other motors to fail.

THAT'S WHY YOU CAN EXPECT superior performance from G-E Tri-Clad motors. Consider these facts:

CORROSION-RESISTANT CAST-IRON means longer motor life. Unlike steel, cast-iron resists corrosive pitting, even when the paint is chipped.

RIGID, CAST STATOR FRAME with integrally cast feet, can't be twisted out of line by accidental jarring or by excessive "bolt-down" pressure on the feet.

STRONG, CAST-IRON END SHIELDS have cast ribs for extra strength without adding extra weight . . . protect the true motor alignment even under heavy shaft loads.

ORDER G-E TRI-CLAD MOTORS from your nearby G-E Apparatus Sales Office or G-E Agent or distributor. General Electric Co., Schenectady 5, N. Y. 752-19

Jou can put your confidence in_
GENERAL & ELECTRIC



How SUNDSTRAND Reduces to Careful Analysis Their Cost Saving Opportunities...

	MACHINE 1952
	Dated April 10, 1952
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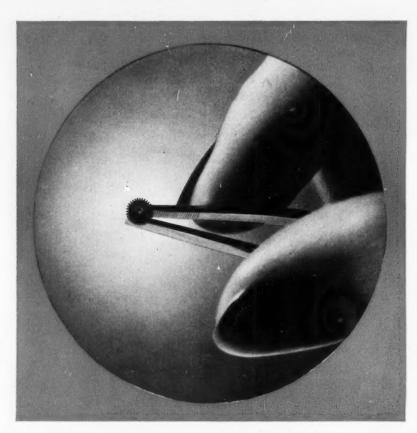
"Here's one example of how we have used a replacement formula as a guide to help us systematically determine which order of replacement should be undertaken...which purchase will give us the most return on our invested dollar."

Bruce F. Olson
President
Sundstrand Machine Tool Co.

- Gain from Replacement under the MAPI Method is...
- .. after the return on the new investment
- . after allowance for future obsolescence of new equipment

ROCKFORD INSERT GROUP

May, 1953.



Hour wheel, .140" diameter with 32 teeth, hobbed with a Borber-Colman special fine pitch hob. Thickness of teeth may not vary more than .0003" on each wheel.

PRODUCTION HOBBING OF PRECISION FINE PITCH GEARS

Up to 270 Diametral Pitch

The high production of accurate fine-pitch gears is a development of Barber-Colman Company. Special techniques have been developed for the manufacture of hobs as fine as 270 D.P. Fine-pitch hobs can be furnished from Class AA to Class C to meet your specific accuracy requirements. Multithread hobs are available for maximum production. In addition to hobs, Barber-Colman makes the machines to hob these fine-pitch gears. Most of these gears are cut on the No. 1-1/2 and No. 6-10 Hobbing Machines, but the Precision No. 6-10 is used for maximum accuracy.

As far back as 1936, Barber-Colman Engineers were making hobs and machines for cutting gears as small as ½" diameter and with teeth as fine as 160 D.P. Continuous development since this time has resulted in standard production techniques for gears up to 270 diametral pitch. Unground hobs are available to 270 D.P., ground hobs to 200 D.P., and carbide-tipped hobs to 150 D.P. Such tolerances as .0003" total composite error and .0002" tooth-to-tooth composite error are possible on gears of the finer pitches.

RULL DERS OF PRECISION GEAR

MADE IN

ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP

ILLINOIS, U.S.A.

Muchinery, May, 1955

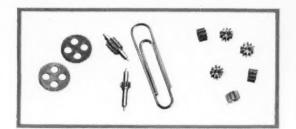


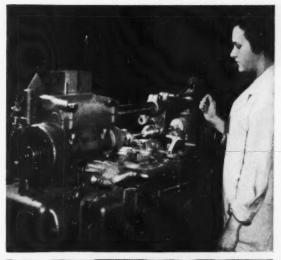
120 D.P. Instrument Gears

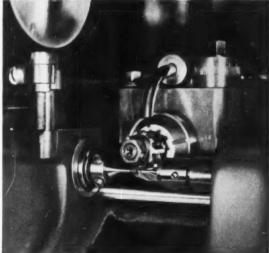
Typical of the range of fine pitch work in the plant of a large precision instrument maker, this hobbing job requires a good grade of commercial gear on a high volume basis. A battery of three Barber-Colman No. 6-10 Hobbing Machines produces 6000 gears per hour with 50 blanks mounted on an arbor. Close tolerances are consistently maintained at this rate of production. Fast loading and unloading is accomplished with air-operated tooling equipment. Here are the specifications: 50-tooth Spur Gears, 120 D.P., .422" O.D., .030" face in brass. Hob—11/8" x 1" x 1/2", Ground Multithread. Feed per revolution of work .020"; Hob Speed 1200 rpm.

180 D.P. Pinions

On another job, precision small pinions, .111" O.D. x .086" face, 18-tooth, 180-pitch are hand loaded and hobbed within a tolerance of .0003" on the pitch diameter on the No. 1-1/2 Hobbing Machine. Since extra fine finish is required a feed of .012" per revolution of work is used with an hourly production of 270 gears. Hob speed is 1795 rpm. A Barber-Colman ground hob, 3/4" O.D. x 1/2" x .315", averages 850 pinions between sharpenings. Special tooling for magazine loading of the No. 1-1/2 machine is available as extra equipment.







When you require small gears, in pitches up to 270 D.P. in high volume production with close limits of tooth accuracy, call your Barber-Colman representative for assistance. With the precision and engineering built into Barber-Colman Hobs and Machines, he can help you reduce such problems to ordinary gear cutting procedure.

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES



Barber-Colman Company

GENERAL OFFICES AND PLANT, 625 ROCK STREET, ROCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911



MADE IN

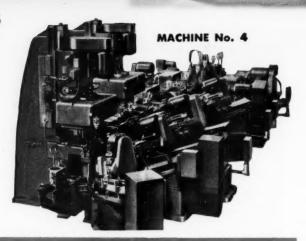
FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD

Machinery, May, 1953

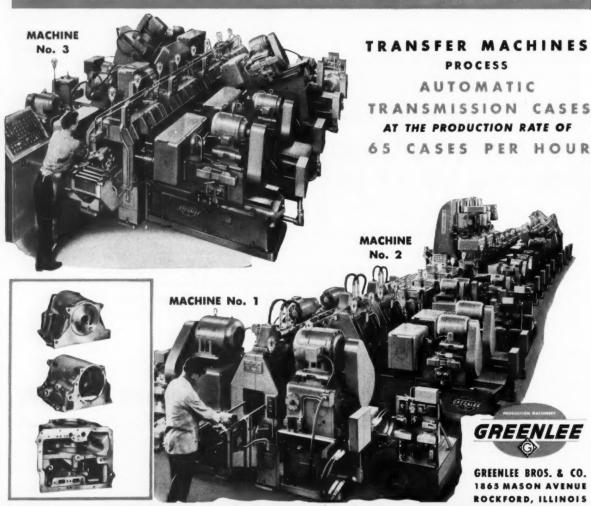
ILLINOIS, U.S.A.

208 OPERATIONS IN 44.3 SECONDS

These recently-built Greenlee transfer machines mill, bore, drill, ream, and tap transmission cases for a well-known automobile. A total of 183 tools complete 208 operations in an automatic cycle time of 44.3 seconds. Features include face and end-milling heads, turnover and chip-cleanout stations, and indicator lights for tool changing. Self-contained hydraulic units conform to JIC standards for easy maintenance. These outstanding machines are among the newest built by Greenlee — a pioneer in progressive transfer-machine principles.



GREENLEE



MADE IN

ROCKFORD... FOR ACCURATE, FAST METAL REMOVAL

ILLINOIS, U.S.A.

Machinery, May, 1955

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES . AUTOMATIC SCREW MACHINES . AUTOMATIC TRANSFER PROCESSING MACHINES



use KOPY-KAT duplicating

TO SIMPLIFY FORM MACHINING





Kopy-Kat duplicating is a fast, inexpensive way of reproducing identical forms. No expensive templates are needed. Forms are transferred direct.

For the L & W Tool & Manufacturing Co. at Milwaukee, Wisconsin, a Rockford Kopy-Kat machined a mold within limits of ± .002", using a simple flat stock template. They found the surface finish to be excellent, and the best obtained compared with any other method.

The entire machining time, including set-up for both work and template, was 39 hours floor-to-floor for both parts of the mold. The above illustration shows the convex part of the mold being machined. The concave part and the template are shown in the closeup view.

See the Kopy-Kat in action before selecting production duplicating equipment. A Rockford Machine Tool Co. representative will give you complete information.



Write for Bulletin No. 12B



ROCKFORD .

ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET

ROCKFORD, ILLINOIS

MADE IN

CENTER OF MACHINE TOOL EXCELLENCE...ROCKFORD

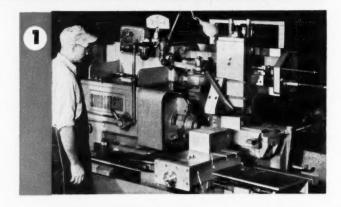
Machinery, May, 1953

ILLINOIS, U.S.A.

How To Turn Out More Work On Jobs Like These ...

Small Lot Turning

This Model 12A Automatic Lathe is one of a Sundstrand turning battery in production on components of heavy road building machinery. Over two to one production increases are obtained on the various cast iron and steel parts. Lot sizes range from 150 to 200 pieces. Ease of set-up for different operations provides high production advantages on small lot turning.



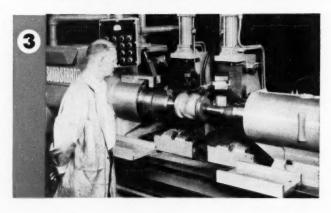
Long Run Turning

Here's a Model 8A Sundstrand Automatic Lathe tooled to produce 250 bevel gear blanks per hour. Two parts are mounted on an arbor so that two gear blanks are completed with each cycle of the machine. Like all Sundstrand Automatic Lathes, this one has all of the modern design features described on the opposite page.



Special Turning

Both ends of valve bodies are machined simultaneously on this special Model 16 Lathe. Automatic cycle includes facing flanges, indexing of tools for "phonograph finishing" in a 2nd cut and return. Each carriage mounts a slide on which two tool blocks are vertically indexed in two positions. The work is held between centers on an arbor, and tools are positioned to the work by air operated sight target. All adjustments and starting of cycles are made





RIGIDMILS

AUTOMATIC LATHES

HYDRAULIC EQUIPMENT

MADE IN

ROCKFORD... CITY OF MACHINE TOOL SPECIALISTS

from push button station.

ILLINOIS, U.S.A.

Muchinery, May, 1953



Design Features of SUNDSTRAND **Automatic Lathes** That Make This Production Possible

Greater Horsepower

All new Sundstrand Automatic Lathes have been redesigned for greater rigidity and larger spindle drive motors. They have ample power for use of carbide cutting tools and are capable of doing more work.

Wider Speed Range

Spindle speed range ratios have been increased to 30 to 1 to obtain maximum in cutting efficiency over a wider range of sizes of parts and material. The spindle unit is equipped with two driving gear centers, which increase the range between high and low spindle speeds. In addition, four speed changes can be obtained from one set of gears instead of the usual two.

Wider Feed Range

A wider feed range has been provided to enable the handling of a greater range of parts and materials at maximum cutting efficiency. The New Models 4A, 8A, and 12A have a ratio of 18 to 1 between high and low feeds - Model 16 has an even greater range.

Greater Carriage Adjustment

Both front and rear carriage of the latest Sundstrand Auto-matic Lathes are adjustable full length between headstock and tailstock centers - another important new feature.

Faster Set-Up

Convenient location of pick-off gears for changing spindle speeds and front and rear carriage feeds is provided. and speed chart and pick-off gear storage compartment are readily accessible for quick set-up or changeover.

and rapid return strokes — enables operator to set up cycle quickly and change over from one job to another easily.

Automatic De-Clutching

All new models have been provided with automatic declutching between spindle and spindle motor with self-adjusting magnetic clutch and brake for quick stopping of spindle rotation.

Screw Feed to Front Carriage

All new Sundstrand Automatic Lathes have screw instead of rack feed to the front carriage - resulting in fine finish and long tool life.

4 Models Cover HP Range of 3 to 75 HP

	MODEL 4A	MODEL 8A	MODEL 12A	MODEL 16
SPINDLE MOTOR	3 to 10 HP	10 to 25 HP	20 to 50 HP	50 to 75 HP
SPEED RANGE (Type A) (Type B)	60 to 1800 RPM 120 to 3600 RPM	40 to 1200 RPM 80 to 2400 RPM	30 to 900 RPM 60 to 1800 RPM	15 to 750 RPM
FEED RANGE	.003 to .048 IPR.	.004 to .070 IPR	.004 to .070 IPR	.0025 to .100 IPR
FRONT CARRIAGE: Longitudinal feed with angular feed-in, max. Swing over cross slide, max. Rapid traverse rate	5″ 83¼″ 275″	6" 12½" 250"	8" 15½" 250"	12" 17" 250"
REAR SLIDE: Max. Stroke	4"	51/2"	61/2"	8"
LENGTH BETWEEN CENTERS	15, 24 & 36"	24, 36, 48 & 60".	24, 36, 48 & 60"	36, 60 & 84"

FREE ADDITIONAL DATA

The complete new line of Sundstrand Automatic Lathes includes the Models 4A, 8A, 12A and 16 ranging from 3 to 75 HP. Write for complete information on these new machines today. Ask for bulletin 631.



SUNDSTRAND

SUNDSTRAND

Machine Tool Company

2530 Eleventh St. Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES

SPECIAL MILLING AND TURNING MACHINES



MADE IN

YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN ... ROCKFORD

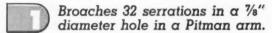
ILLINOIS, U.S.A.

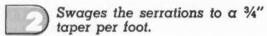
Machinery, May, 1953

broaches and some local local

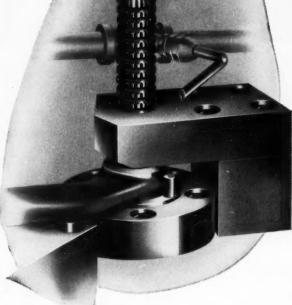
broaches and swages more than 160 pars per hour

Accuracy and power combined on an American 25 ton press—





Your next broaching problem can be solved more economically by broaching the American Way . . . because American designs and builds all three . . . broaches, machines and fixtures. To start American engineers working on your problem, send a partprint or sample and hourly requirements. Write today for Circular No. 300.





The broaching stroke is started by manual control. The broach and swage assembly is held in accurate alignment by twin guide posts built integral with the broach push head. The 32 serrations are broached and then swaged under 25 tons pressure in one pass. On the return stroke, the broach is stripped from the part by a plate in the fixture.





See Ancesiase First — for the Best in Broaching Tools, Broaching Machines, Special Machinery



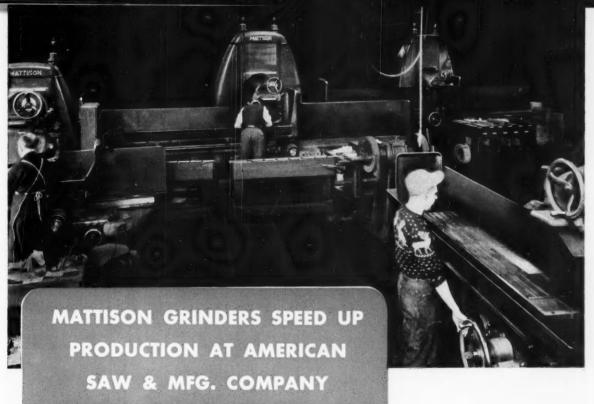
MADE IN

ROCKFORD... FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION

ILLINOIS, U.S.A.

Machinery, May, 1933







• The four Mattison High Powered Precision Surface Grinders shown above are used by American Saw & Mfg. Company for the grinding of annealed tool steel strips and bars on a real production basis in the manufacture of Lenox Precision-Master Ground Flat Stock. Exacting manufacturing specifications demand excellent finishes within close limits of accuracy.

The massive double column support, high power and rigidity of construction of the Mattison Grinder combine with accuracy and speed of operation to insure consistent precision results on a high production basis for American Saw & Mfg. Company. For complete information regarding the capabilities of the Mattison High Powered Precision Surface Grinder send for free circular.

MATTISON

MACHINE WORKS

ROCKFORD . ILLINOIS



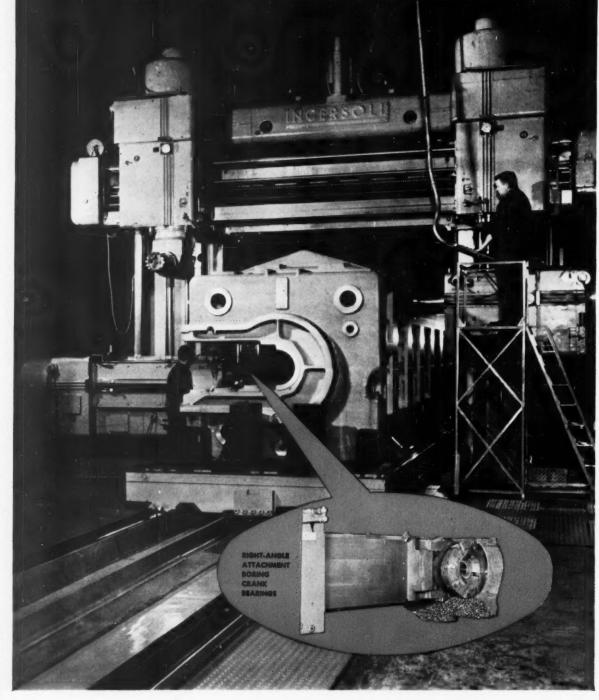
MADE IN

YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN...ROCKFORD

Machinery, May, 1953

ILLINOIS, U.S.A.

INGERSOLL



MADE IN

ROCKFORD... MACHINE TOOL SHOPPING CENTER

ILLINOIS, U.S.A.

Machinery, May, 1953



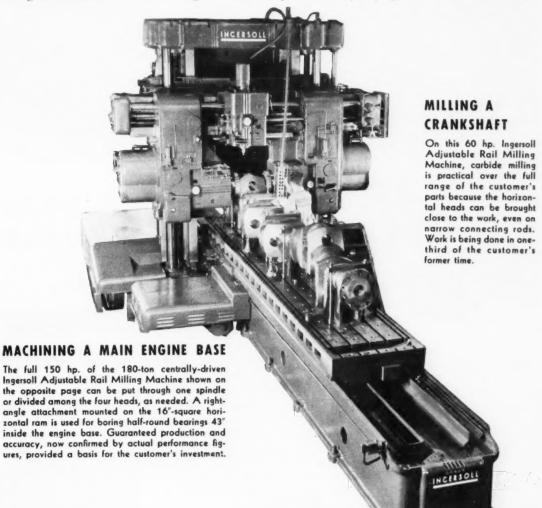
SPECIAL MACHINES FOR A WIDE RANGE OF DIESEL ENGINE WORK

Ingersoll built these two machines for a manufacturer of stationary diesel engines after a careful study of the customer's production problems.

The study showed that a large, specially designed 4-head Adjustable Rail Milling Machine with a horizontal ram not only would do all the milling of the main frame, but also could be used for boring the crank line without resetting the work.

This method produces extremely accurate bores at a substantial time saving.

For milling the customer's crankshafts, camshafts and connecting rods, we recommended a smaller machine, with horizontal heads traveling on the crossrail. This unusual feature makes it possible to take heavy carbide cuts in forged and cast steel parts of widely varying diameters and thicknesses.



THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS



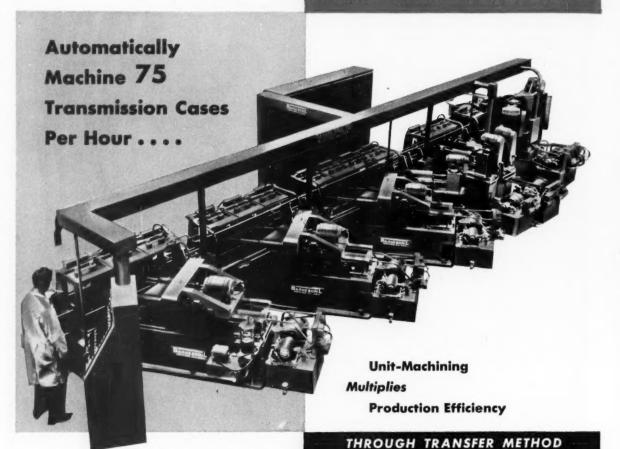
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ROCKFORD MADE MEANS PRECISION MADE...ROCKFORD

Machinery, May, 1953

ILLINOIS, U.S.A.

BARNESDRIL TRANSFER MACHINES



This modern high production machine is one of a battery of twelve machines built by BARNESDRIL engineers for one plant to process a complete line of similar parts. Production is 75 complete cases per hour at 70% efficiency, drilling, reaming, counterboring and milling. Automatic oiling system and chip conveyor are standard features.

Ask BARNESDRIL Engineers for estimates on your multiple-operation parts. They can suggest methods for high machining efficiency at minimum cost.



BARNES DRILL CO.

820 CHESTNUT STREET . ROCKFORD, ILLINOIS

MADE IN

ROCKFORD... A CONVENIENT SOURCE FOR PRODUCTION NEEDS

ILLINOIS, U.S.A.

Machinery, May, 1953





EKSTROM, CARLSON

H-121 "POWER-ARM"

CONTOUR ROUTING and MILLING MACHINE

Powerful!

Fast-cutting!

Easy to Operate!



DEPT. M-4
EKSTROM, CARLSON & CO.
1400 Railroad Ave.
Rockford, III.

Do you want to banish, forever, tedious, back-breaking manual routing in the machining of your aircraft parts? Then, here's EKSTROM, CARLSON's solution! This machine, conceived by us, is specially designed to provide greater production at lower cost when templaterouting and milling today's heavy aluminum plate or thick stacks of tough-cutting aluminum sheets. Hydraulically-operated, the entire operation is effected from a "Utopian" remote control pushbutton stand that starts the motors, lowers the head for template contact prior to the actual cutter descent, and controls the speed, rapid traverse, and direction of travel. The spiral-flute, collet-mounted router bit (also an ECCo product) is direct-driven by a high-cycle, 30 hp motor at 14,400 rpm. Even an inexperienced operator can quickly learn how to "pilot" the head around the most intricate template, and can then proceed to turn out an amazing quantity of work. For further details on this entirely new and revolutionary machine, write us TODAY . . . and learn all about it!

FOR GREATER AIRCRAFT PRODUCTION!



MADE IN

FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD

Machimey, May, 1953

ILLINOIS, U.S.A.

Rehnberg-Jacobson

MACHINE FOR MILLING TRANSMISSION BAND LEVERS

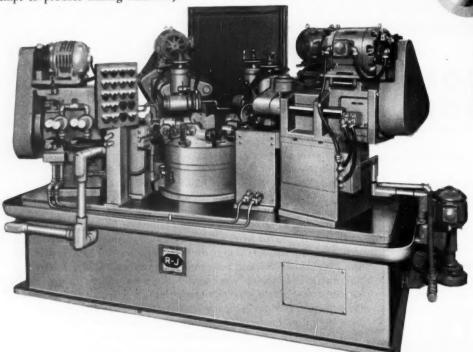


This is one of several machines delivered to a prominent automobile plant for use in manufacturing a new transmission. The piece, a kickdown band lever, is machined from a tough steel forging. The machine countersinks and spot faces one end of the hub and mills the V-slot in 3 passes,

first to remove about 3/3 of the material, then down to .010", and finally finishing. R-J No. 45 Drill Units drive the four heads, 3 of which are right-angle milling heads with clamped handwheels to adjust for cutter wear. The machine is rated at 100 pieces per hour capacity.

This didn't start out to be a milling machine, but

to drill and ream a conical hole. When this was changed to a V-slot, it was necessary to modify the machine by incorporating three milling fixtures (though we do not normally attempt to produce milling machines).



REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY



2135 KISHWAUKEE ST. ROCKFORD, ILLINOIS

MADE IN

ROCKFORD...MACHINE TOOL PLANTS CLOSE TO YOUR PLANT

ILLINOIS, U.S.A.

Machinery, May, 1953



Barnes J.I.G. CODE MACHINE TOOL DOWER UNITS



HERE IS A
"STANDARD"

MODEL

UNIT

FJ-300

FOR MANY
APPLICATIONS

The 30-gallon hydraulic unit illustrated is one size of a standard series of basic units of sufficient flexibility to cover a wide range of applications.

All models meet J. I. C. requirements of design and manufacture. Emphasis is on accessibility of equipment for servicing, and on centralization of the hydraulic components, tubing, and wiring.

All models are completely engineered — assembled — piped — wired — and tested — READY TO GO!

May we talk to you about specific uses for these "Standard" units?

BRANCH OFFICES

503 New Center Building Detroit 2, Michigan 3254 Lincoln Avenue Chicago 13, Illinois 132 East Hanover Street Trenton 8, New Jersey

SALES REPRESENTATIVES

Rees Machinery Company
1012 Empire Building
Pittburgh 22, Pennsylvania
B. W. Rogers Company
850 South High Street
Akron 9, Ohio
Standard Machine & Tool Co.
870 Ottawa Street
Windsor, Ontario, Canada
W. H. Del Mar Co.,
3931 W. Slawson Ave.

INDUSTRIAL
and AUTOMOTIVE
HYDRAULICS

JOHN S. BARNES CORPORATION ● 305 S. WATER ST., RCCKFORD, ILLINOIS



MADE IN

FOR METAL REMOVAL WITH ACCURACY AND SPEED...ROCKFORD

Machinery, May, 1953

ILLINOIS, U.S.A.



IMPROVED HAND SCRAPER



Anderson's Model 5 hand scraper is light in weight, easier to use with palm fitting comfort grip, and faster cutting. Three sizes: 18", 20", 22" long. Furnished with high speed steel or Carboloy Blades.



ANDERSON BROS. MFG. CO.

1907 Kishwaukee St. ROCKFORD, ILLINOIS



POWER SCRAPER has a "natural hand control" ... left hand serves as guide to the blade, and the right hand regulates the stroke. A slight forward pressure on cylinder with right hand starts swift, smooth forward stroke which can be regulated from nothing to $3\frac{1}{2}$ feet ... 60 feet per minute, reverse speed 90 feet per minute. Has a $\frac{1}{4}$ H.P. motor, easily portable. Write for more information today.

MADE IN

ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS

ILLINOIS, U.S.A.

Machinery, May, 1953





Currently, draw dies of Carboloy cemented carbide are speeding up production on everything from shoe eyelets to .30 cal. brass cartridge cases and 155 mm. brass and steel shell casings. Send coupon for details on carbide draw dies.

Carbide dies outdraw steel dies 10 to 20 times on shell cases



Field engineering — At your call, a Carboloy die expert will drop around to your plant and help solve your carbide die problems. Call him whenever you want on-the-spot answers on design and application of carbides in dies.



Dies equipped with Carboloy cemented carbide really stand up in production of steel shell cases. Even under terrific hour-after-hour continuous drawing, they wear 10 to 20 times longer than steel dies and deliver an extremely high finish.

Other drawing applications — similar benefits.

Such benefits are not unusual from Carboloy drawing dies. On some applications, they'll outwear other dies by 50 to one. The same holds true for blanking, forming and piercing dies made of Carboloy cemented carbide.

Naturally, when dies wear like this, you get greater production with less downtime and maintenance . . . fewer rejects and less finishing . . . cash savings all down the line.

Whether you make or use press dies, simple or complex, for any die operation, explore the possibility of applying Carboloy cemented carbide to those dies. You can order Carboloy cemented carbide in finished or in rough form from Carboloy Department. On blanking dies, order rough carbide direct from Carboloy Department to be finished in your own or tool maker's die room. Expert Carboloy die specialists will assist you in carbide die design and application.

To get a better idea of the wide range of carbide dies and free Carboloy die services, send coupon.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

Die training school — Courses in design, application and maintenance of carbide dies are given free at Carboloy Die School. Plan to enroll your men now. Send coupon for information.

Check and Mail Today

"Carboloy" is the registered trademark of the Carboloy
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- Rush me free Carboloy Die Engineering Manual D-124.

 Send complete details on Carboloy Die School.
- ☐ Have a Carboloy field representative call at my plant.

Company

Address

City Zone State

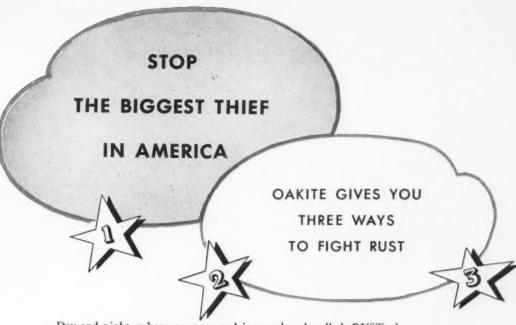
One-Stop shopping for brass rod and bar You can get rod or drawn bar of Chase Free-Cutting Brass, Copper or a wide variety of Warehouse nearest you!

other copper alloys at one stop - the Chase When you want free-cutting materials, it pays

to buy Chase - for Chase rod and drawn bar yield the shorter chips that make for easier machining, longer tool life. They produce smooth, clean-surfaced products - less expensive to buff or polish before lacquering, enameling or plating.

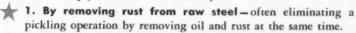
And when it comes to re-ordering, remember that Chase alloys are uniform - repeat orders of the same alloy always have the same cutting characteristics.

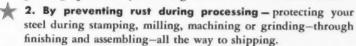
COPPER The Nation's Headquarters for Brass & Copper

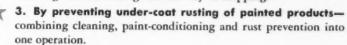


Day and night-wherever your steel is stored or handled-RUST, the biggest thief in America, is robbing you of production, robbing you of profit.

Oakite can help you defeat rust three ways:









One department saves \$1,000 a month

An enterprising foreman for a large Eastern manufacturer of precision steel parts kept a six-month record of the results of a special anti-rust campaign in his department.

anti-rust campaign in his avoing of time for-After determining the saving of time formerly spent on re-processing rusted parts, he told the Oakite Technical Service Representative who had helped in the campaign: "This saving has been over \$1,000 a month."

Today the company is intensifying the anti-rust campaign under the competent direction of that foreman—and is extending the campaign to other departments.

One of their chief weapons in stopping rust-during grinding, polishing, tumbling, assembly and other operations—is Oakite Special Protective Oil.

A 16-page illustrated booklet on "How to prevent rust with Oakite Special Profective Oil" is included in the FREE Oakite Anti-Rust Kit offered in the coupon.

FREE For the Oakite Anti-Rust Kit that tells about these three ways to stop RUST e in your plant, just drop us a note or mail the coupon.

0	AKITE
	NATERIALS - METHODS - SERVICE
OA	KITE PRODUCTS, INC.
26	Rector St., New York 6, N. Y.
Plea	ase send me the FREE Oakite Anti-Rust Kit.
I ar	n particularly interested in:
	Removing rust from raw stock.
	Preventing rust during processing.
	Preventing under-coat rusting of painted products.
Vame.	
Comp	any
lelelse	<i>5</i> ′



This Block Body for a Tension Reel represents the coordinated effort of many National Forge skills in turning out the required electric alloy steel, the proper heat treating and the intricate machining to exacting tolerances.

National Forge offers you complete forging

service in one plant—under one responsibility.

Why not take advantage of this "all-in-one" service the next time you need forgings?

For full information, write NATIONAL FORGE AND ORDNANCE COMPANY, Irvine, Warren County, Pennsylvania.

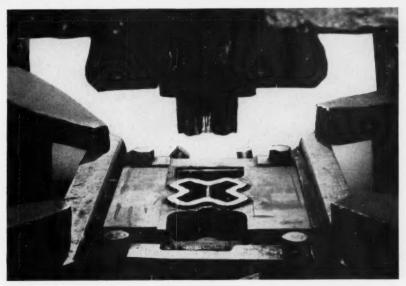


Tool Steel Topics

BETH EHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehom products are sold by Bethlehom Pacific Coast Steel Corporation. Export Distributor: Bethlehom Steel Export Corporation



In the center is the four-piece, composite trimmer die used in one of the service tests on Lehigh H tool steel. In the cold-trimming of 20,000 drop forgings, the two die components hardened by the high-temperature, "short-cut" method showed only one-half as much wear as the other two die components heat-treated in the usual way.

"SHORT-CUT" Hardening Improves Wear of High-Carbon, High-Chrome Steels

Production men often lose patience, even tear out their hair, while waiting the many long hours necessary for the heat-treatment of tools and dies made from the high-earbon, high-ehromium tool steels. When treating large dies, for example, it's not unusual to have a pack-hardening cycle of 24 hours or even longer. But until lately there's been no short-cut that doesn't result in improperly treated tools.

Faster Treatment

That's why we're happy to report that our research men are developing a much faster method of heat-treatment — one that not only promises to save valuable time, but also imparts better wear-resistance than the usual heat-treatment for high-carbon, high-chromium steels.

It's a high-temperature treatment that does the trick. Ordinarily these grades are hardened by a long soak at 1850 F, followed by air-quenching. The new treatment involves a much shorter soak at about 2100 F. By no means perfected as yet, this new wrinkle was developed in

a series of experiments in which the dies hardened at 2100 F were used in actual production work along with similar dies hardened at 1850 F.

Longer Wear

Dies used for cold-trimming drop forgings, for example, were hardened by both methods. These were composite dies, each made up of four assembled sections. Operating conditions were exactly the same. Careful measurements were made at regular intervals to determine the amount of wear between the cutting edges opposite each other. After trimming 20,000 forgings, the wear of the die edges was .012 in. on the pair of trimmer-die components treated by conventional methods; on the dies hardened by the high-temperature cycle the wear amounted to only .006 in. — just half as much.

Data Now Available

Tests are continuing. If you'd like to have the details of our work to date, drop us a line at Bethlehem, Pa. Address your request to Room 1037A, Publications Department, Bethlehem Steel Co.

BETHLEHEM TOOL STEEL ENGINEER SAYS:



Here are five fundamentals of successful toolmaking.

It's always a challenge for toolmakers to produce tools or dies which will be both hard enough to stand up in service and ductile enough not to crack, either in the making or in use. To get the necessary ductility, most tools are hardened below the maximum obtainable.

Once the proper balance between hardness and ductility has been determined in service, the maintenance of this balance helps to assure good performance. But good tool performance depends on more than that. In fact, there are these five fundamentals which must be considered:

- 1. Good tool design
- 2. Sound tool steel, of proper grade
- 3. Correct heat-treatment
- 4. Proper grinding
- 5. Proper application of the tool

These five fundamentals are like links in a chain; a deficiency in any one of these steps, or links, can lead to trouble. Poor tool design, for example, may often result in quenching cracks. Careful attention paid to each of these factors will help you to get the best tool life.



RESTRIKE DIE

This restrike die made of A-H5 tool steel is one of the precision tools used in making parts for torque converters. A-H5 has better wear-resistance than standard oil-hardening steel and holds more accurately to size during heat-treatment. It's a general-purpose, air-hardening grade containing 5 pct chromium, yet it's as economical as most oil-hardening tool steels.

CUMBERLAND GROUND BARS

We manufacture 8" diameter, 7-1/2", 7", 6-1/2", 6", and also odd and intermediate sizes down to and including 1-1/8".



ON THE WIST VINSINIA SHORE, OVERLOOKING THE POTOMAC RIVER, STANDS THE JAMES RUMSEY MONUMENT

The first practical steamboat in the world was run on the Potomac River a few miles below Cumberland, Maryland.

GEORGE WASHINGTON said in his diary, under date of September 6, 1784: "Remained at Bath all day and was showed the Model of a boat constructed by the ingenious Mr. Rumsey, for ascending rapid currents by mechanism; the principles of this were not only shown, and fully explained to me, but to my very great satisfaction, exhibited in practice in private under the injunction of seerecy-

At a later date George Washington said in his diary: "Spent the afternoon with Mr. Rumsey and then Alexander Hamilton and I rode on to Cumberland, Maryland."

BERLAND STEEL COMPANY



Symbol of Quality

Approximately 100 years after the exhibit of this steamboat, Cumberland began grinding bars. They found through experience this was the best method by which accurate steel bars could be produced. These bars are so carefully ground that they are adapted for mass production where gears, pulleys, sprockets and bearings must slide on the bars without delay due to fifing or fitting.

IMMEDIATE BARS

DISTRIBUTED BY

Baltimore, Maryland—Addison Clarke & Bro.
Besten, Mass.—Hawkridge Brothers Company
Bridgeport, Conn.—Hunter & Harens, Inc.
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Chicage, Ill.—Central Steel & Wire Co.
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Fort Worth, Frata—C. A. Flacher
Hartford, Conn.—Hunter & Harens, Inc.
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Providence, R. I.—Congdon & Caspeniar Co.
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Worcester, Mass.—Pratt & Imman

CUMBERLAND, MARYLAND, U. S. A. ESTABLISHED 1845 INCORPORATED 1892 ESTABLISHED 1845



These two high speed bits do nearly all general machining jobs!

Are you confused by all the grades and varieties of steel toolholder bits? Well don't be. It is true that there are many to choose from, and for some jobs special or unusual requirements indicate the need for highly specialized bits. Leave such cases up to your tool supplier.

But for 95% or more of general machining operations, where steel cutting tools are used, you need only TWO grades Firth Sterling CIRCLE C and VAN-CHIP. These two will handle the widest possible range of general machining work and are recommended by Firth Sterling as all-purpose tools.

IN STOCK AT YOUR CONVENIENTLY LOCATED FIRTH STERLING DISTRIBUTOR

CIRCLE C - GROUND BITS

Circle C is a durable, heavy duty, super high-speed steel for high production. Its cutting capacity is far beyond that of ordinary high speed steel. Circle C Bits will withstand rough usage and cut heat-treated steels of hardness in excess of 350 Brinell. Recommended for heavy cutting of alloy steel, high-manganese steel, cast iron, cast steel, heat-treated steel parts and stainless steels. Conveniently and durably packaged in dozens and half dozens for tool crib storage.

VAN-CHIP - UNGROUND BITS

A 6-6-3 High Speed Steel with high carbon and vanadium content that produces superior abrasion resistance. Van-Chip is an unusually tough, durable bit for general machining. Well adapted to difficult cutting operations such as machining heat treated sections, castings and similar hard materials to particularly close tolerances. Stocked in 5 pound boxes.

High Speed Steels • Tool & Die Steels • Stainless Specialties • High Temperature Alloys

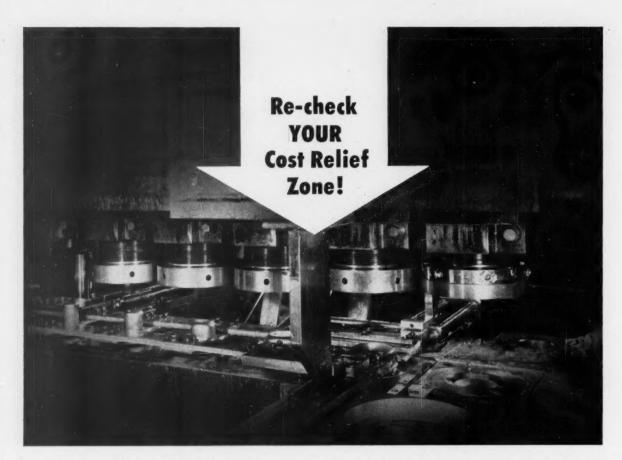
Sintered Tungsten Carbides • Chromium Carbides • High Temperature Cermets • Firth Heavy Meta.

OFFICES* AND WAREHOUSES: HARTFORD NEW YORK* DETROIT CLEYELAND DAYTON* PITTSBURGH* CHICAGO BIRMINGHAM* LOS ANGELES PHILADELPHIA*



GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

MACHINERY, May, 1953-97



Every Man Responsible for Tooling and Production Can Take This Step Now and Get Results I

Re-check your tools and dies... investigate this immediate source for new cost economies like hundreds of other plants are doing! You'll often be able to reduce costly die maintenance, shutdowns for regrinding...and step up output between grinds.

Records in hundreds of plants prove it possible. Look at the job shown above. A re-check of these punches and dies that produce muffler heads on an automatic transfer press, showed that a different die steel with the following properties was needed: (1) More uniform, through hardening, (2) Higher wear resistance, (3) Greater safety and accuracy in heat treatment. It was found that all of these properties were provided by *one* tool steel—Carpenter No. 610 (Air-Wear). Now, after many months of dependable service, the No. 610 tools are

still averaging 200,000 units per month, and costs are in line.

One such case is not complete proof. But when many other plants report similar cases of cost relief, it adds up to an opportunity for you. Try this now: Use the Carpenter Matched Set Method to select the one steel best suited to cut costs. This Method is backed by *dependable* tool and die steels that stay on the job. Then, for rush delivery, call your nearest Carpenter Mill-Branch Warehouse or Distributor. The CARPENTER STEEL Co., 105 W. BERN ST., READING, PA.

Are You Missing These Opportunities In Your Cost Relief Zone?

- Less die finishing and adjusting
- · Greater output between grinds
- •Fewer heat treating failures
- Less machine downtime

On Job After Job Carpenter Matched Tool and Die Steels Have Made Them Possible!

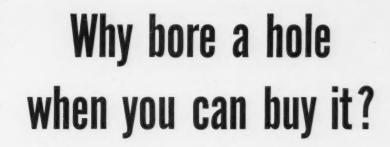




Matched Tool and Die Steels

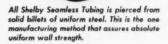
Export Department: The Carpenter Steel Co., Port Washington, N. Y .- "CARSTEELCO"

Mill-Branch Warehouses and Distributors in Principal Cities Throughout the U.S. A. and Canada



SHELBY SEAMLESS STEEL TUBING

comes to you with the hole and basic shape already made!



THIS FREE BOOK

tells how you can cut production cost and make better parts. Write for it today!



• It costs money to bore a hole through solid stock. It takes time. It wears out tools. It wastes steel. In other words, it's poor economy.

By using Shelby Seamless Mechanical Tubing you can eliminate or greatly reduce many time and labor consuming operations connected with boring and machining.

Shelby Seamless Tubing is available in a complete range of sizes; in different wall thicknesses; various finishes and steel analyses... with the basic shape already made... and with the hole built in. Another important advantage in using Shelby Tubing is that its excellent machining characteristics and uniformity speed up production and improve the quality of your output. You can turn out parts by the millions and the last part will be as metallurgically and dimensionally accurate as the first.

Why not talk to National's engineers about the economic advantages of using Shelby Seamless Tubing? You can be sure that any recommendations they make will be based on a thorough study of your particular requirements.

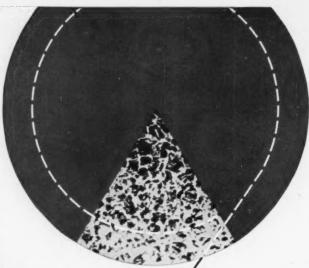
NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA

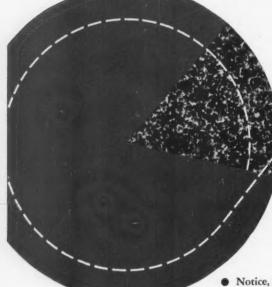
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



U·S·S SHELBY SEAMLESS MECHANICAL TUBING

The "decarb" (lightcolored) area in the ordinary heat-treated bar at right must usually be removed before parts can be made from the stock.





Republic
Carbon-Corrected
Alloy Steel Bars
help you
make a profit

Notice that this Republic carbon corrected alloy steel bar has had full carbon content restored to outer edges by carbon correction • Notice, above at the right, the "decarb" area in the outer edge of the cross-section of a cold drawn alloy steel bar as ordinarily heat treated. Then compare it with the cross-section below at the left. Notice how the carbon has been restored by carbon correction even to the extreme outer circumference.

Here, in the outer rim of Republic Carbon-Corrected Alloy Steel Bars, is the profit-area for your machine tools . . . the part of the bar you don't have to machine away into chips and shavings.

Let our Republic 3-Dimension Metallurgical Service work with your metallurgists and production men to adapt Republic Carbon-Corrected Cold Drawn Alloy Steel Bars to your products. Your Republic Steel salesman can arrange for the Republic Field Metallurgist to call at your convenience.



3-DIMENSION Metallurgical Service

... combines the extensive experience and coordinated abilities of Republic's Field, Mill and Laboratory Mecallurgists with the knowledge and skills of your own engineers. It has helped guide users of Alloy Steels in counties industries to the correct steel and its most efficient usage, IT CAN DO THE SAME FOR YOU.

REPUBLIC STEEL CORPORATION

Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

Republic cold DRAWN REPUBLIC STEEL BARS

ON MINNEAPOLIS-MOLINE'S UNI-HARVESTOR BY USING HIGH-STRENGT The UNI-HARVESTOR is really different. It harvests grains, beans, and all seeds—it picks and husks corn, and bales or chops hay. Ground and Polished STRESSPROOF is speci-fied for the cylinder shaft. **GROUND AND POLISHED STRESSPROOF** INSTEAD OF C1045 In designing this Cylinder Shaft, Minneapolis-Moline engineers specified Ground and Polished STRESSPROOF to meet the increasingly severe operating conditions to which this equipment is subjected. The alternative would have been lower strength shafting with an increase in size. The larger shaft would have been 44% heavier, and bearings and gears would have had to be redesigned. Ground and Polished STRESSPROOF proved to be stronger, had better fatigue properties, and machined better. It eliminated heat-treating and straightening operations, and the size accuracy provided a correct bearing mounting. STRESSPROOF makes a better part at lower cost. STRESSPROOF is a severely cold-worked, furnace-treated, earbon steel bar with a unique combination of four qualities SEND FOR . . in the bar: (1) Strength, (2) Wearability, (3) Machinability, Free Engineering Bulletin "New Economies in the Use and (4) Minimum Warpage. Yet it costs less than other of Steel Bars" quality cold-finished steel bars. Available in cold-drawn or ground and polished finish. La Salle Steel Co. 1428 150th Street Hammond, Indiana Please send me your STRESSPROOF Bulletin. Title the Most Complete Line of Company-Carbon and Alloy Cold-Finished Address... and Ground and Polished Bars in America. City-Zone State

WE'VE MADE MILLIONS OF THEM



On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation





52100 tubing shipped within 24 hours after you order!

GOT a rush hollow-parts job? The Timken Company will ship less-than-mill-quantities of 52100 tubing within 24 hours after receipt of your order.

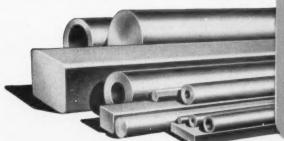
Timken® 52100 steel will do most of your hollowparts jobs. It can be heat treated to file hardness and tempered back to any desired point. A high carbon steel, it is through-hardening in moderate sections, has high wear resistance and can often be used in place of more expensive steels. And it comes in sizes from 1" to 10½" O.D.

Here's a partial list of hollow-parts jobs for which Timken 52100 steel is used: aircraft parts, ball bearing races, pump parts and plungers, collets, bushings, spindles, grinding machine parts and precision instruments.

The Timken Company's unmatched experience, as a pioneer producer of 52100 tubing, has resulted in uniform quality from tube to tube and order to order. Rigid quality control checks every step of production.

For immediate delivery of your less-than-mill-quantity orders, write, wire or call The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD -THROUGH EXPERIENCE AND RESEARCH



TIMBEN
PROCESSION OF PINO ALLOY

STEEL

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

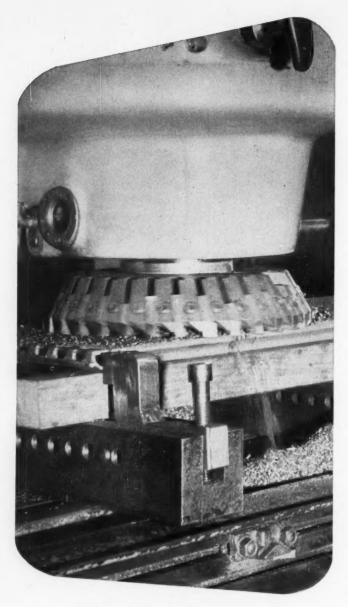
MACHINERY, May, 1953-103

A WEEK'S FINISHING DONE IN A DAY

HAYNES STELLITE alloy milling cutter blades recently solved a tough finishing problem in the production of cast iron mold jackets. Face-milling operations with harder tool materials failed because of chipping and spalling of the cutter blades after finishing only a few castings. Then the foundry tried grinding the jackets. But this was too slow; it took at least 30 minutes to grind each one.

A switch to HAYNES STELLITE Star J-Metal blades cut finishing time to a mere six minutes per casting. An extra saving results from the long life of the HAYNES STELLITE alloy blades. They produce about 350 pieces per grind.

HAYNES STELLITE alloy tools are ideal for cast iron milling jobs because of their high compressive strength at cutting temperatures, good impact strength, and extremely low coefficient of friction. Contact our nearest District Office for on-the-job help with your machining problems, or write for the new manual, "HAYNES STELLITE Metal-Cutting Tools."



This 12-in. diameter cutter, containing 32 HAYNES STELLITE alloy inserted blades, removes 1/16-in. of stock from cast iron mold jackets. A 36-in. casting is milled with this setup in about 1/5 the time required for grinding.



Haynes Stellite Company

A Division of
Union Carbide and Carbon Corporation

General Offices and Works, Kokomo, Indiana Scles Offices

Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa

"Haynes" and "Haynes Stellite" are trade-marks of Union Carbide and Carbon Corporation.

Rex® High Speed Steels

tool steel is the cornerstone of our business

Just as the cornerstone is of fundamental importance to a building, tool steel is the base of our business. And ever since we were founded — now over 50 years ago — we have been proud of our reputation as the nation's leading producer of tool steels.

We have always given our customers what they needed — quality and service — regardless of their volume of business or the general supply and demand situation. During last year's steel shortage, for instance, all our customers had their share of our production.

You too, can benefit from our long experience in this field through our freely available metallurgical service...and from our reliable delivery service through our fully stocked warehouses, conveniently located all over the country.

SÉND TODAY for the unique Crucible Tool Steel Selector — a twist of the dial gives the tool steel for your application.

Peerless Hot Work Steels
Halcomb 218
Chro-Mow®
Sanderson Carbon Tool Steels
AirKool Die Steel
Airdi® 150
Nu-Die V Die Casting Steel
CSM 2 Mold Steel
La Belle® Silicon #2

SPECIFY
YOUR TOOL STEELS
BY
THESE
BRAND NAMES

Crucible Steel Company of America
Dept. M, Chrysler Building, New York 17, N. Y.
Name
Company
Title
9" diamete
3-colors

CRUCIBLE

first name in special purpose steels

53 years of Fine steelmaking

TOOL STEELS

CRUCIBLE STEEL COMPANY OF AMERICA . TOOL STEEL SALES . SYRACUSE, N. Y.



of Tool and Die Making —you Buy <u>Less</u> Steel and <u>Reduce</u> Machining Costs

Write for New Booklet:

CAST-TO-SHAPE

TOOL STEEL

Gives you full details on FCC Air Hardening, Oil Hardening and other Cast-To-Shape Tool Steel Specialties capable of saving you time and money.

> Get Your Copy— Write for it Today

ADDRESS DEPT, M-41

FCC Cast-To-Shape, the modern method of tool and die making, is effecting important savings of time, trouble and money for an increasing number of manufacturers.

Even very intricate shapes can now be cast successfully within an eighth inch of finished size. This means that you buy less steel at the start and reduce machining costs substantially.

Tools which could not be made by conventional methods except in sections can often be fabricated from FCC Cast-To-Shape blanks in a single piece.

In many instances performance of the tool is better than can be obtained by

fabrication from bar stock or forgings.

Particulars are available through Allegheny Ludlum representatives; or write for the booklet today.

LLEGHENY

STEEL CORPORATION
Pittsburgh, Pa.

Forging and Casting Division

MICHIGAN

WAD 1696

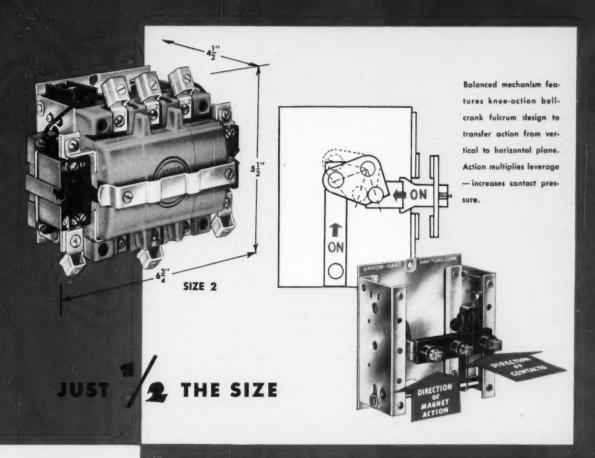


HERE'S THE BIG STORY MENIND

ARROW-HART'S DEVELOPMENT

OF THE TYPE "RA"

MOTOR CONTROL DESIGN



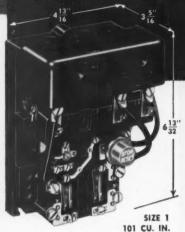


A REVOLUTIONARY DESIGN
THOROUGHLY TESTED AND PROVED TO
PROVIDE SUPERIOR OPERATING PERFORMANCE
IN HALF THE SPACE • WITH LESS WEIGHT

PROGRESS IN DESIGN MAKES THE DIFFERENCE

HERE ARE THE FACTS OF THE ARROW-HART ADVANCEMENT OF Magnetic **MOTOR CONTROLS**

105 CU. IN.



ARROW-HART'S

1930

CLAPPER TYPE STARTER

COMPACTNESS

Much wasted space; contacts over magnet . . . overload relays below.

UNDERVOLTAGE RELEASE

POOR - dependent on gravity working through an inefficient linkage angle.

CONTACTS

Single break type.

CONTACTS

Double break type.

more efficiently applied.

COMPACTNESS

AUXILIARY ELECTRICAL INTERLOCKS

Available, but could not be added conveniently.

Available, but could not be added conveniently.

AUXILIARY ELECTRICAL INTERLOCKS

ARROW-HART'S

DIRECT-ACTING SOLENOID TYPE

STARTER

Some improvement, but still far from ideal.

Still entirely dependent on gravity, but now

UNDERVOLTAGE RELEASE

CONTACT ALIGNMENT

No positive guidance, no sure alignment.

WIRING

"Scrambled Wiring" with load terminal on line side and crossing circuits. Difficult to wire and lacking the safety factor of circuit separation.

ARC SUPPRESSION

CONTACT ALIGNMENT

No positive guidance, no sure alignment.

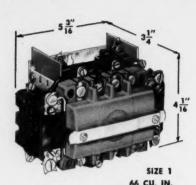
FAIR but lacking complete separation of arcing chambers. Hood and base of Bakelite -- best material available then.

WIRING

"Scrambled Wiring" with load terminal on line side and crossing circuits. Difficult to wire and lacking the safety factor of circuit separation.

ARC SUPPRESSION

FAIR but lacking complete separation of arcing chambers. Hood and base of Bakelite - best material available then.



THE EXCLUSIVE ARROW-HART

"RIGHT ANGLE" DESIGN

JUST 1/2 the SIZE and WEIGHT of any other control on the market.

UNDERVOLTAGE RELEASE

Positive and independent of gravity. Able to operate properly in any position - even upside down.

CONTACTS

Double break type PLUS greater accessibility for easy inspection or replacement.

AUXILIARY ELECTRICAL INTERLOCKS

Easily and conveniently added to provide added utility. Available N. O., N. C. and N. O. - N. C.

CONTACT ALIGNMENT

Contact movement is positively guided through its entire travel. Exact alignment is assured at all times.

WIRING

In-built STRAIGHT-THRU WIRING without the use of bus-bars. Fast and easy to wire; circuits safely separated.

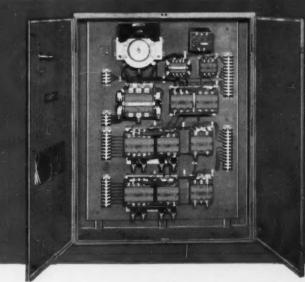
ARC SUPPRESSION

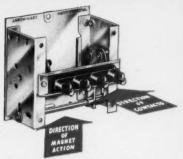
EXCELLENT — Individual arcing chambers completely isolated. Hood and base of alkyd plastic that resists arcing and tracking more than 50% better than next best material.

YOUR ELECTRICALLY OPERATED EQUIPMENT Demands MODERN MOTOR CONTROLS



"RIGHT ANGLE" DESIGN Motor Control Line MOST ADVANCED LINE AVAILABLE ANYWHERE





"RA" PRINCIPLE ACCOUNTS FOR SMALL SIZE

SUPERIOR



POSITIVE RELEASE ACTION IN ANY POSITION

RUGGED CONTACTS





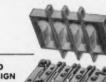
AUXILIARY ELECTRICAL INTERLOCK

GUIDED CONTACT TRAVEL





SIMPLE TO WIRE EASY TO TRACE



TONGUE AND GROOVE DESIGN





In a recent 10 year period, lathes, for example, were improved in 43 separate categories, many of which resulted in time savings of 200 to 300% for the performance of a specific operation. Don't handicap your machines and equipment with 1930 controls. Specify Arrow-Hart "RA" Controls and be assured of full rated performance.

THE "RIGHT ANGLE" OPERATING MECHANISM, an exclusive Arrow-Hart feature, represents the first real advance in motor control design since the introduction of the original solenoid type. This revolutionary new concept makes it possible to build superior performance and added working advantages into a control just ½ the size and weight of any other now on the market. The timetested bellcrank principle is utilized to produce a mechanical advantage that enables a small, compact magnet to outperform the old fashioned, direct-acting type. Action is transferred from a vertical to a horizontal plane - less weight is wastefully lifted against gravity. Operating efficiency, dependability and service life are greatly increased. Other important refinements such as Straight-Thru Wiring, guided parallel closure of contacts for superior alignment, and easily attached Auxiliary Electrical Interlocks are made possible by the space-saving simplicity of this design.

THERE'S AN ARROW-HART "RIGHT ANGLE" MOTOR CONTROL FOR EVERY APPLICATION

Regular, Reversing and Multi-Speed Starters are available in Sizes 0, 1, 2, 3, 4, 5.—Contactors in Sizes 00, 0, 1, 2, 3, 4, 5. NEMA Type enclosures can be supplied for general service and for use in hazardous and exposed locations.

SEND FOR LITERATURE COMPLETE WITH RATINGS, DIMEN-SIONS, WEIGHTS and ENGINEERING DATA.

INDUSTRIAL CONTROL DIVISION THE ARROW-HART & HEGEMAN ELECTRIC CO. 103 Hawthorn St., Hartford 6, Conn., U.S.A.



HERE'S IMPORTANT INFORMATION

DESIGN ENGINEERS
PLANT MANAGEMENT
PURCHASING AGENTS
ELECTRICIANS
MANUFACTURERS
and EVERY OTHER USER OF
INDUSTRIAL MOTOR CONTROLS

Here is the Att HIM Amountain Motor County Coloring with Ad Information on the sating Ad United the controls shown helps and missy same types—are inducted General description and application sections are supplemented by excepting angineering data including ratings, weights and disconsions, and writing diagrams. Additional section will be invest to observe all ones matches of modifications of thing are made another than A bandy ordering there and price supplement against the variety.

Whatever your re-pleasant, there is an Arten-Heirt milton control example to with eighther equipment designed and built to do the job — and do if hotter, it's easy to flad the light unit to do YOUR job in the A-H Catalog. Sand for your copy today.





PUSH BUTTON CONTROLS



"OO"



"RAS" MULTI-SPEED STARTER



"NF" MANUAL

STARTER

EXPLO-SAFE STARTER



LOAD-LIMIT



"RT" MANUAL STARTER

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY 103 HAWTHORN STREET, HARTFORD 6, CONNECTICUT

Please send my free copy of the catalog, "INDUSTRIAL MOTOR CONTROLS"; I am particularly interested in the following type(s) of equipment:

NAME_____

POSITION____

CO. NAME_____

TONE___STATE

ARROW·HART

INDUSTRIAL CONTROL DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY

Omess, Julea Engineers and Warehouses; the ATLANTA BOSTON, BURFALO CHARROTTE, CHICAGO, CHARROTHAMAT, CETTERMAN, AALAS DETROIT, HOUSTON, HOLANDAMAFOLIS, RANSAS CITY MO., LOS ANGELES, MEWAUREE, MINNEAPOLIS, NEW YORK, PHILADELPHIA, PITYSSUNGH, ST. LONIS, SAN PRANCISCO, SYEACUSE, Shar Salas Regissors in Columbus, Oblis, Provincially Memory York, Manchanter Con., Secretal, Springfield Marss., In Concada: AMAGUS-MART & HEQUIMAN (CANADA)



Mr. Wilson, Vice President Thompson Grinder Company Springfield, Ohio

Dear Mr. Wilson:

We recently installed a new THOMPSON Tool Room Grinder to grind Gage Blocks to our specifications and in spite of the close timits have been very satisfactory, in spite of the close timits to would be interested in the performance of this machine.

Very truly yours,

COMPANY

WEDBER GAGE COMPANY

Thompson 2F Grinder Photo-aphed in the Webber Gage Co., Cleveland Plant

COMPARE THIS NEW 8 x 10 x 24 TOOL ROOM GRINDER

Compare These Features:

- HARDENED AND GROUND cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings. HARDENED AND GROUND sealed anti-friction
- · HARDENED AND GROUND BED WAYS with
- 3600/1900 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.

Handy control panel.

- Elevation micrometer stop graduated in .0601".
- GROUND THREAD FEED SCREW.
- Automatic wheel TRUING device.
- Longitudinal hand wheel with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005"
- GROUND THREAD FEED SCREW.

Thompson

WRITE TODAY for complete specifications and performance data. Address Dept. 10, Thompson Grinder Co., Springfield, Ohso.

When working to a tolerance of four mil-lionths of an inch such as is observed when nonino of an inco sails as is observed when making Webber Gage Blocks, the rough or preliminary grinding plays an important role in keeping cost of the final finishing within reasonable limits.

COPYRIGHT 1951 BY THE THOMPSON GRINDER CO.

The only manufacturer of a complete range of heavy duty and light duty surface and contour grinders for industry.

SURFACE Grinders

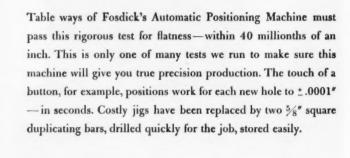
The Thompson Grinder Company, Springfield, Ohio

MACHINERY, May, 1953-111



Here's another reason it pays to get a proposal from Fosdick

We check flatness to 40 millionths



to give you

Boring Time "Nose Dives" at Fairchild.

Mass production of precision magnesium housings for commercial and military cabin pressurizers at Fairchild Engine and Airplane Corp. demanded speed and high accuracy. Fosdick's proposal recommended Automatic Positioning Machines. Now Fairchild drills, faces and bores \$1/32" holes with accuracy to ± .0001"— has slashed boring time 40% over former methods.



For full description of the Automatic Positioning Machine ask for Bulletin APM

precision production like this

Need Drilling Equipment? Get a Proposal from Fosdick!



Radial Drills



Jig Borers



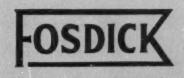
Sensitive and



Sensitive Radial Drills



Automatic Positioning



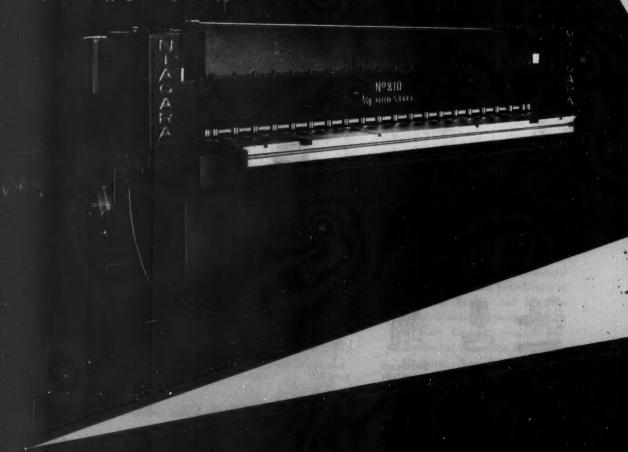
THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

A GAB

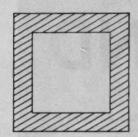
Accuracy in a squaring shear is dependent on rigidity of the shear's components and not upon any individual feature.

Sturdiness, convenience, speed and dependability are the result of experienced engineering and superb manufacture.

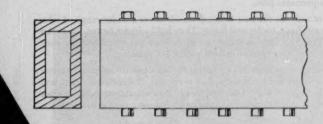
Latest type Niagara No. 810 Power Squaring Shear. Arranged with electro pnuematic tripping device operated by foot switch.



BASIC SHEAR DESIGN Results in Accurate Cutting





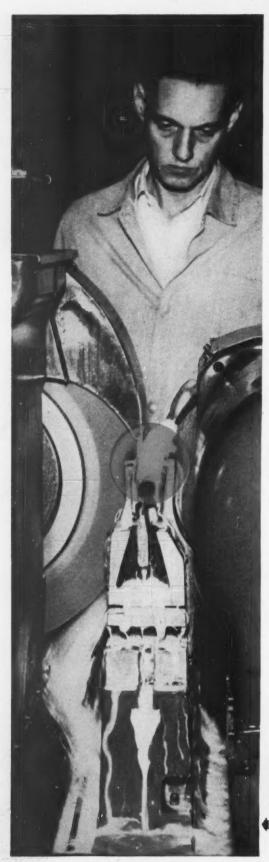


BED, CROSSHEAD, HOLDDOWN and HOUSINGS in NIAGARA UNDERDRIVE SHEARS are box sections to resist with minimum deflection the horizontal, vertical, diagonal or torsional stresses to which every shear is subjected. No other section will do the job as efficiently. This construction results in extreme strength and rigidity without resorting to deep beam sections which, in the bed, necessarily project below the floor line.

The simple, mechanically operated holddown having individual self compensating pressure feet, performs all required functions of a good holddown efficiently, effectively and quietly without using complex hydraulic circuits, pumps, valves, packings, cylinders, etc. and without generating heat. Maintenance costs are held to a minimum.

The drive is thru efficient spur gears mounted on anti-friction bearings and running in oil. It employs the famous Niagara 14 point instant engaging sleeve clutch. There are no sliding surfaces such as in worm gears and friction clutches to consume power, generate heat, and to wear rapidly.

NIAGARA MACHINE & TOOL WORKS · BUFFALO 11, N. Y. Manufacturers of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work DISTRICT OFFICES: DETROIT · CLEVELAND · NEW YORK



Add the "TOUCH OF GOLD" to your grinding with the NEW Norton G BOND

Here, ready to bring you immediate benefits, is the most radically improved vitrified bond ever produced. It's the new Norton G Bond — and every time it goes to work for you it applies that "Touch of Gold" that cuts your grinding costs and increases the value of your products.

Combined with Norton ALUNDUM* abrasives, this new bond is outstanding as an aid to lower-cost grinding in many precision and semi-precision jobs.

Not only do the new G Bond wheels cover a wider range of jobs, they cut freer, cooler and faster. They hold corners better, are better for form grinding. And they do more work per wheel because they dress easier and produce more pieces per dressing.

Every one of these advantages is the result of five years of research and field-testing by Norton. And every one of them means time and money saved—the "Touch of Gold" that adds more value to your products and increases your profits by reducing your grinding costs.

How the New G Bond assures more efficient cutting action

ALUNDUM abrasive grains are held by the G Bond until they've done the most effective cutting job, then released to make way for new grains with fresh, sharp cutting edges. It's this unique ability of the new bond to hold the grains just long enough that keeps the wheel's grinding surface at constant peak efficiency.

Your Norton distributor

has the types and sizes of new G Bond ALUNDUM wheels you need for best results. Ask him about arranging a test in your plant. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

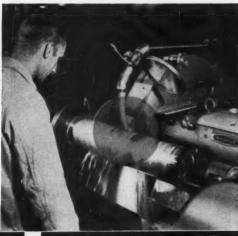
SOMETHING NEW IN HIS EXPERIENCE. It takes a lot of proof to convince grinding machine operators that one vitrified bond can be so much more efficient than another. Yet the new Norton G Bond has already made plenty of friends in plants throughout the country. How about getting your own shopmen's reactions to the "Touch of Gold"?

Make these 3 easy tests . . .

LOOK! You can see the difference in the spark stream of a Norton G Bond ALUNDUM wheel. No intermittent sparking, but a continuous, even stream that means uniform cutting action.



LISTEN! Norton G Bond wheels grind with the pleasant, steady swish-h-h of free, easy cutting. You hear no harsh grinding noise.





EXAMINE! On precision jobs, especially, you'll get the results you want faster. And every job you do with the new G Bond will benefit by their new, unique cutting action.



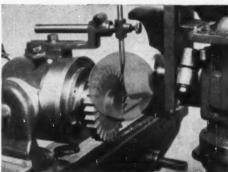
G BOND WHEELS HANDLE MANY JOBS, big or little, simple or complicated. You'll find them particularly valuable for such types of grinding as cylindrical, centerless, surface, internal, gear, tool and cutter, form and thread grinding and saw gumming.





Making better products to make other products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries



W-1480



THE PRESS THAT WORKED ITSELF INTO A JOB!

This KRW 150-ton motor-driven Hydraulic Press works all day—every day—testing dies made by Phinney Tool & Die Co., Medina, N.Y. Some of these dies are small enough to fit in the palm of your hand; others weigh up to thousands of pounds.

Phinney had one interesting experience that demonstrates the amazing versatility of this Press. They received an order for a series of 4 progressive dies from a maker of tank parts. Phinney made the dies, tested them, and shipped them. A short time later the dies came back. They were excellent, but the customer didn't have a press large enough to run

them. Would Phinney put the dies in production on the same Press that made the sample parts? Phinney accepted. And this same KRW Hydraulic Press has since turned out thousands of tank parts in addition to its regular work of testing dies.

You'll find the versatility and rugged construction of KRW Hydraulic Presses can save you time and money on many operations in your shop. 25-150 ton capacities; one, two or three cylinders; hand, air or motor driven. Write us for complete specifications and prices. Dep't. 15.

K-R-WILSON

215 MAIN ST., BUFFALO 3, N. Y.



Designers and Builders of the Right Hydraulic Press to Solve Your Metal-working Problems!



TAPS by CARD

Many years of designing and manufacturing one chief product make Card the foremost name in Taps.

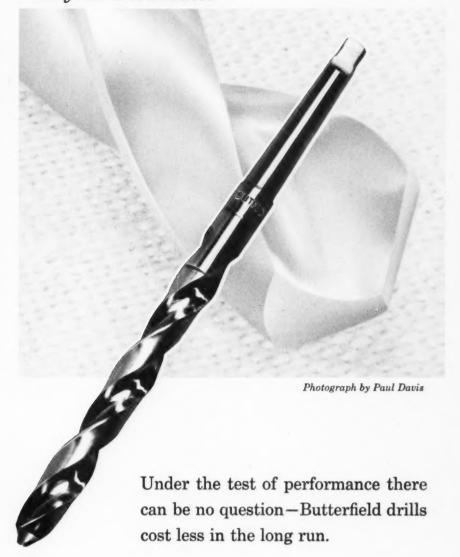
Completely stocked offices at Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco and Seattle.

See your local Card distributor for prompt deliveries and helpful service



Designed to take it ATHOL, MASSACHUSETTS UNION TWIST DRILL COMPANY Gear Cutters Twist Drills Hobs Reamers Carbide Tools Milling Cutters OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Manufield, BUTTERIORS DIVISION, Derby Line, Vermont and Rock Island, Quebec

Ask your Distributor



BUTTERFIELD

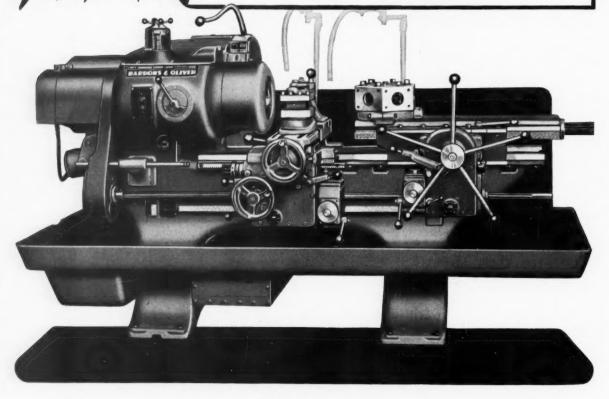
Union Twist Drill Company Butterfield Division Derby Line, Vermont, U. S. A.

TAPS . DIES . REAMERS . DRILLS . COUNTERBORES . SCREW PLATES

NEW

Extra Capacity

No. 7 Ram Type Universal Turret Lathe Takes up to 41/2" dia. Through The Automatic Collet Chuck



The many improvements include more power, higher speeds, and increased rigidity.

New bar support will adequately handle the weight of $41/2^{\prime\prime}$ dia. solid bars. Automatic Collet Chuck and Bar Feed are hydraulically actuated.

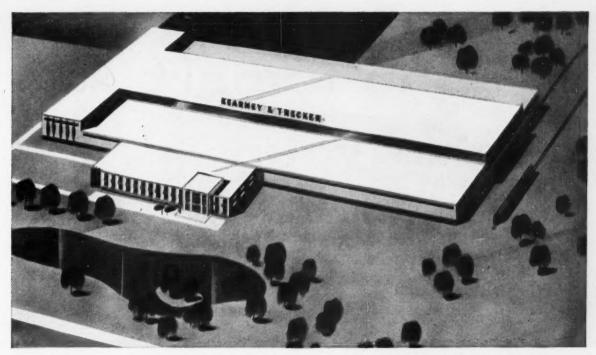
Complete details on request.



BARDONS & OLIVER, Inc.

1135 WEST 9TH STREET

CLEVELAND 13, OHIO



Here it is! Kearney & Trecker's new Special Machinery Division — nearly 200,000 sq. ft. of new plant with new tools and equipment. An experienced, fully-staffed

team of sales, engineering and production experts is ready and waiting to serve you . . . by engineering new production methods.

INCUBATOR...for Production Ideas

This plant is being built for you...to engineer *new* production methods—to build the large or small special machines, tools and fixtures you need to improve production and cut costs.

Production behind schedule?

Costs going up, up and up?

Will special machines, special tools and fixtures or special arrangements of standard machines help you solve these problems?

Then why not be among the first to take advantage of the 5-million-dollar-plus investment that Kearney & Trecker is making in new plant, new tools and new engineering to help you solve them.

Kearney & Trecker is no newcomer to the field of special machine tools and allied special equipment. During the past 50 years millions of dollars worth of Kearney & Trecker special machinery has been produced for plants all over the world. And that doesn't include the 60,000 standard Kearney & Trecker milling machines

and other machine tools so well known and so widely accepted everywhere.

Kearney & Trecker is already working on new production ideas, new equipment and tool designs to be produced in this plant. Kearney & Trecker Special Engineering and Methods Analysts are ready right now to serve you with (1) Prompt response to your inquiry, (2) Immediate engineering help on your problem, plus, (3) The newest, finest and most complete facilities to build the special equipment you need — big or small.

Phone, write or wire The Special Machinery Division, Kearney & Trecker Corporation, Milwaukee 14, Wis., today. Get the facts about Kearney & Trecker's Special Machinery Division and how it can serve you.



Let an Expert solve your Cutting Oil Problem

Hundreds of machine shops, large and small, have eliminated the *chance of error* in selecting the correct cutting fluids for their varied operations.

They solved this common (and often costly) problem with the help of a Sinclair Lubrication Engineer. And by using the right oil for each operation they have improved work quality and stepped up production.

The same expert service is available to you - at no cost. Here's how it works.

Call in a Sinclair Lubrication Engineer to study the machining operations in your shop. He will discuss cutting problems with you and your production personnel. After gathering all information, he will prepare a comprehensive, detailed chart which will guide you quickly to the correct cutting oil for any particular operation.

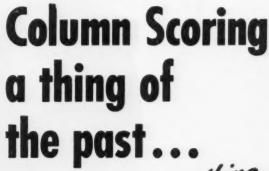
In addition, he will brief your personnel about cutting oils and coolants — storage, mixing, application, waste elimination, sanitation, etc.

Phone your local Sinclair Representative or write to Sinclair Refining Company, 600 Fifth Avenue, New York 20, N.Y.

SINCLAIR CUTTING OILS

Just a memory now

OIL -



We've done something about it—

On the new "AMERICAN" Hole Wizard Radial the arm girdle and its mating column area are automatically oiled and cleansed.

Actuation of the elevating lever operates a plunger pump in the arm girdle forcing oil into the distributing reservoir at the top which lubricates the entire arm girdle area. Abrasion and oil resistant synthetic wipers at top and bottom trap the oil to prevent leakage and thoroughly cleanse the column of all dirt and foreign matter ahead of the arm girdle when raised or lowered.

This positively reduces the danger of column scoring to an absolute minimum — just another "Hole Wizard" feature that insures long life and dependable service.

MEAMERICAN TOOL WORKS CO.

PATENTS PENDING





WHAT Life-Line REALLY DELIVERS IS MORE SERVICE... LESS SERVICING

What <u>life-line</u> really delivers is ... more service ... less servicing

"We can't afford equipment breakdowns. We manufacture ice cream making machinery and operate franchise stores throughout the country. Store operators know very little about maintenance. We must select equipment that assures trouble-free performance with minimum maintenance. That's what Life-Lines give us. That's why we standardize on them."

The above statement by the chief engineer of an eastern manufacturing plant tells the Life-Line story best. Summed up it means more service, less servicing, with Life-Lines.

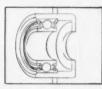
Take the Life-Linestarter, for example. Contacts last longer because exclusive "De-ion®" arc extinction snuffs out arcs fast... reduces contact pitting. Simple seesaw balance of clapper prevents accidental opening; kickout spring prevents accidental closing. Compare with any other starter and see why Life-Linestarters offer more service with less servicing.

The Life-Line motor's advance design completely eliminates periodic lubrication. Pre-lubricated factory-sealed ball bearings need no greasing attention. Further, steel construction cuts breakage from rough usage. Superior insulation and winding techniques lengthen electrical life. On-the-job reports of a half million Life-Lines show why you get more service with less servicing.

It costs no more to get Life-Line performance. Ask your Westinghouse representative for details or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

YOU CAN BE SURE...IF IT'S
Westinghouse





MOTOR

Needs no lubrication. Pre-lubricated factorysealed bearings eliminate troubles due to under or overlubrication, dust and dirt.

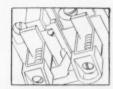


Cuts winding burnouts. Pear-shaped slot design eliminates pockets. No corner voids remain to collect dirt, moisture.

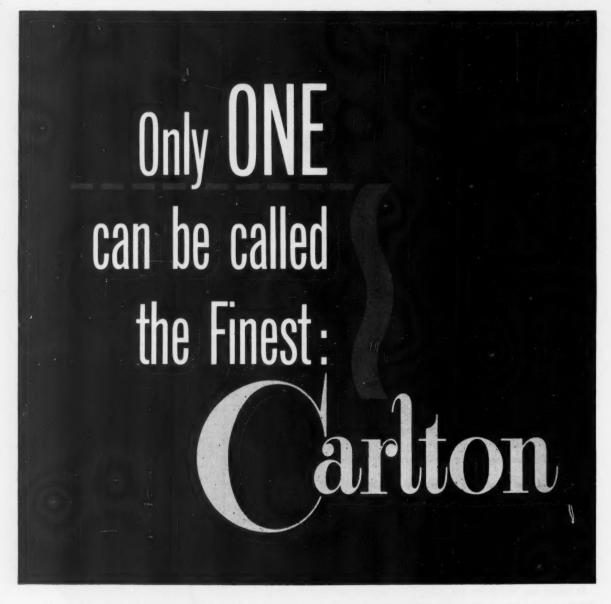


STARTER

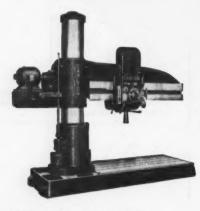
Never Jams. No sliding surfaces to wear-no sticking-no jammingnothing to wear or replace.



Never needs filing. Silver-to-silver contacts eliminate filing. Discolored silver maintains high conductivity.



... here's another good reason why: low maintenance cost



CARLION RADIAL DRILLS cost less to maintain because they are designed for less maintenance attention. For example: there's only one friction clutch to adjust. There are no tapered gibs to adjust because the head travels across the arm on hardened steel ways. Automatic lubrication throughout eliminates the damage and unnecessary wear that occurs in ordinary radial drills.

compare carlton and you'll buy carlton. Judge for yourself why Carlton radial drills are the first choice of American industry. Write for bulletins. The Carlton Machine Tool Co., Cincinnati 25, Ohio.



Red Shield says:

"STANDARD for tough jobs since 1881"



as near as your telephone



Call your Industrial Supply Distributor for Shield Brand Milling Cutters. Specialized factory service available everywhere.

STANDARD TOOL CO. TOOL CO.

NEW YORK . DETROIT . CHICAGO . DALLAS . SAN FRANCISCO



Cities Service Cutting Oils Proved The Very Best By Micrometer Test!



CUTTER MEASURED WITH MICROMETER. As a final test, Automatic Pencil Sharpener measures each cutter with a micrometer. All tests proved that Cities Service cutting oil was absolutely tong for this really tough in the service.



STRICT SPECIFICATIONS REQUIRE FINEST CUTTING OIL.
APSCO Sharpeners offer many more features than other
brands. To produce their top quality product, SpenglerLoomis relies on top-quality lubrication products.

ONLY .005 INCHES BURR OR BUILD-UP ALLOWED IN FIFTY-HOUR OPERATION CUTTING GROOVE IN B1112 STEEL!

Says Mr. C. J. Kostrzewa, Plant Superintendent: "Cutting oil requirements in our Automatic Pencil Sharpener Division are tough. To find the right coolant, we called for, and tested, samples from various companies. Over a period of testing time, we used graphs, charts and tables, keeping a running record on all coolants. As a final test, we measured the cutter with a micrometer before and after milling. The cutting oil that came out tops was Cities Service.

"I'd also like to point out that the Cities Service Engineering staff cooperated fully by offering helpful advice and excellent service."

Why not discuss your lubrication problems with a Cities Service lubrication engineer? Write Cities Service Oil Company, Dept. 2 14, Sixty Wall Tower, New York 5, New York—or contact your nearest Cities Service office.

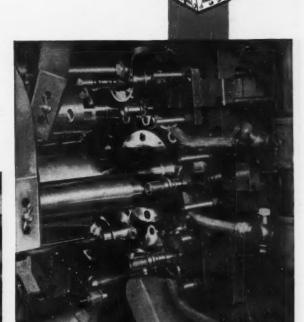


PIECES FROM EIGHTS

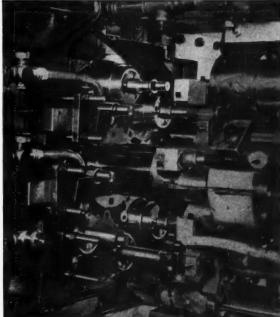
The first eight spindle bar automatics were introduced in 1930 by the late Frank L. Cone, founder of the Cone Company.

CONOMATIC Eights have had the usual opportunities available to any production tools that can handle added requirements and responsibilities.

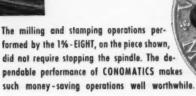
With more tool positions than other "automatics", Eight Spindle CONOMATICS have an advantage in taking on, at one chucking, operations that save the costs of second handling.



Rear Side of Tooling Area



Front Side of Tooling Area



A Comparison of ALL Automatics is in favor of Cone

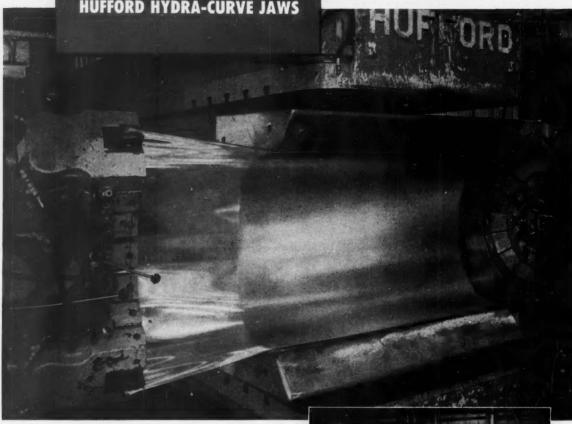


Conomatic CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

"Bath-Tub" Deep!

HUFFORD HYDRA-CURVE JAWS

Here's the latest Hufford development that simplifies stretch-wrap forming of deep concavities or convexities. By pre-curving sheets to approximate cross sectional die contour these new HYDRA-**CURVE JAWS bring many advantages:**



LESS STOCK USED-Vertical die curves no longer need to be stretched into the workpiece. Less stretching results in lower stressing. On deep curvatures this means less stock required between die ends and jaws. Result: Up to 30% savings in material.

DOLLAR SAVINGS-One manufacturer reports material savings of \$335 per day, besides faster, easier forming and more accurate skin fits, which again cut costs.

LESS WRINKLING-No need to stretch wrinkles out of the workpiece. Pre-curving eliminates most wrinkling before it starts.

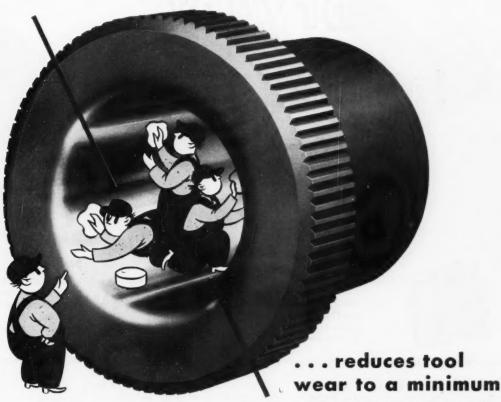
SAVES FURNACE HOURS—Many parts are now formed directly from material in the "ST" condition.

DIE COSTS CUT-Time consuming dish-outs in dies-to help reduce transitional stresses-are no longer necessary.

Once again, here's proof that the BEST in stretch-wrap forming comes FIRST from HUFFORD! Ask for facts.



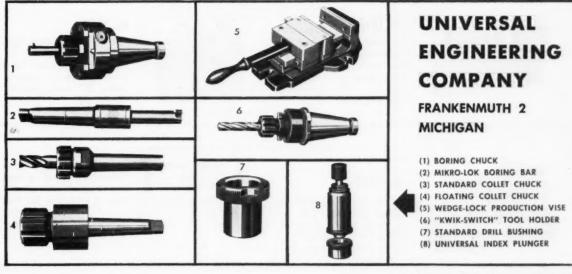
SUPER FINISH OF UNIVERSAL DRILL BUSHINGS . . .



One sure way to cut excessive tool wear in your operations is to specify Universal Drill Bushings because their superfinish bores help reduce wear on production tools to an absolute minimum, especially in close tolerance work.

The blended radius on the top inside diameter helps prevent tool hang-up and breakage.

100% concentricity and hardness tests insure accuracy, uniform high quality and long life. Knurled heads provide a quick, sure grip. Universal Drill Bushings are produced in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N.J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.



bryant internal grinding



no. 1309-W

Finishes 2 bores and a taper straight and concentric. 2 wheelheads are used on this semi-automatic. Max. traverse stroke, 6". Max. grinding length, 31/2".



no. 1109

For high production of small bores where accuracy of size and finish are required. Max. traverse stroke, 6". Max. grinding length, 3½".



no. 2209

For precision and high production grinding of ball bearing races, gears, rolls, bushings, etc. Max. traverse stroke, 6". Max. grinding length, 34".



no. 1116

A general purpose hole grinder for tool room, small shop, or general production. Maximum traverse stroke, 20". Maximum grinding length, 8".



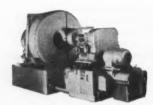
no. 1416

Specially designed for grinding bores in long work, such as machine tool spindles. Maximum traverse stroke, 20". Maximum grinding length, 8".



no. 1209

A fully automatic, high production machine for small and medium bore grinding. Max. traverse stroke, 6". Max. grinding length, 3".

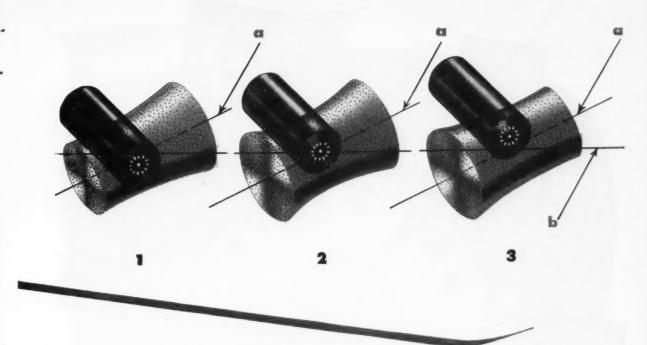


no. 1460

For production or single piece hole grinding on parts up to 60" diameter. Max. traverse stroke, 21". Max. grinding length, 16".



"Alignment for Better Internal Grinding", a new, sound color moving picture is available for free showing to engineering groups. Write for descriptive booking form.



USERS of internal grinders generally believe that once the grinding wheel passes the diamond, the form of the wheel will be a perfect cylinder. If the wheelhead is tipped so that its center line is not parallel with the motion of the longitudinal ways, the wheel cannot be trued to a perfect cylinder. In our illustration each wheel is tipped as it passes the diamond. Even though the diamond describes a straight line across the surface of the tipped wheel, the wheel will not be trued to a perfect cylinder. This is because the wheel is not being moved on a path along its own center line. When the wheel is tipped so that its center line "a' does not coincide with its direction of travel "b" as the wheel passes the diamond, an apparent taper "1" or "3", or an hourglass "2" will be generated on the wheel. The vertical position of the diamond determines which one of these three forms will be produced on a tipped wheel. In this case we have two variables; that is, the wheel axis "a" may not coincide with its direction of travel "b", and the diamond may be above or below center.

Taper due to tipping of the wheel can be identified by raising or lowering the diamond. If the wheel is tapered as in "1" and after raising the diamond the form changes to "2" and again, after raising the diamond, the taper changes to "3", the front of the wheel (left end in illustration) is low and the wheel is tipped down. On the other hand, if the small diameter of the taper moves from right to left on the wheel as the diamond is progressively raised, the front of the wheel is tipped up.

An error in wheel form similar to those illustrated cannot produce a good hole either for size or shape, since there can be no straight line of contact for the full length of the wheel and the full length of the work as the wheel traverses. Furthermore, this distortion in the form of the wheel cannot be eliminated by simply turning the workhead. The remedy is to correct the alignment by bringing the wheel center line parallel with the wheel path (direction of wheel travel) and to the same height as the workhead center line, and setting the diamond in the plane established by the wheelhead and workhead center lines.

Bryant Chucking Grinder Company Springfield, Vermont, U. S. A.

Internal grinders . Internal & External thread gages



Supreme in its field, this mobile monster moved from drawing board to proving ground in record breaking time. Once there, it proceeded to shatter performance records too... a real tribute to the superb engineering and production power of the Army Ordnance Corps and the Chrysler Corporation.

BAY

BAY STATE abrasive products, among others, were used to accomplish this feat. In particular, BAYFLEX reinforced disc-wheels were used by many Chrysler suppliers for grinding "miles" of tank-hull welds.

BAY STATE is proud to play its part in this modern miracle of stepped-up production. We salute the Patton 48 and the forward-moving program of Army Ordnance and Chrysler.

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass.

Branch Offices and Warehouses — Chicago, Cleveland, Detroit, Pittsburgh Distributors — All Principal Cities In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ontario

ALL TYPES OF QUALITY PRODUCTS FOR GRINDING

tapping cast steel plate is tough, rugged work

BAUSH

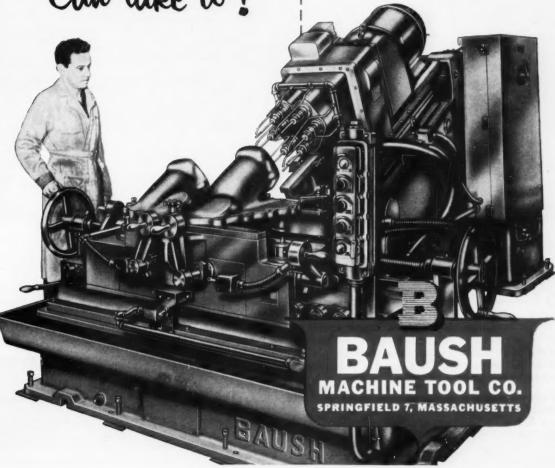
Can take it!

Plants working on heavy armored units for defense find that the inherent rugged quality built into every Baush machine tool for more than fifty years, meets every demand they have for producing results that are uniform, economical and free from troublesome and costly breakdowns.

This unit illustrated is a Baush Special Angular Individual Leadscrew Tapper arranged for tapping holes in both upper and lower bosses of CAST STEEL housings. Furnished with a six (6) spindle fixed-center individual leadscrew tapping head mounted on a hydraulic slide (for approach and return of head), that makes two passes to complete the tapping of six (6) ½ x 13 in two different height bosses of each part.

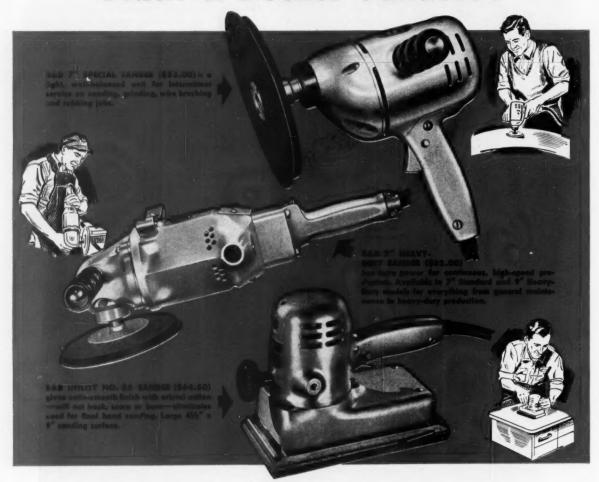
Both machine and fixture can accommodate two different housings.

Parts are loaded into fixture proper, locating from two movable pins that enter reamed construction holes in the flange and are clamped down with planer type clamps. The fixture slide is located by hand-operated shot bolt that is interlocked electrically. Slide operates by screw and hand wheel.



From fast material removal to satin-smooth finishing . . .

Speed up your surfacing jobs with Black & Decker Sanders!



Powerful, versatile, perfectly balanced!

WHETHER you're surfacing metal, wood or compositions... in production, construction or maintenance... Black & Decker Sanders are the tools for you! You have your choice of four rotary models to drive abrasive discs, saucer grinding wheels, "Whirlwind" wire cup brushes, rotary gouging and planing heads... plus the new orbital model that gives a satin-smooth finish 10 times faster than by hand.

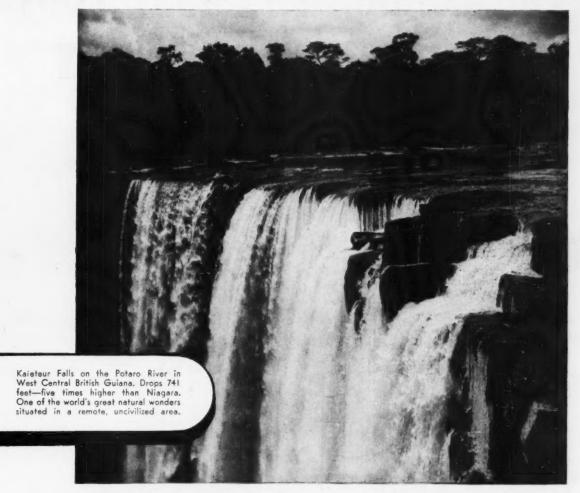
Whatever your choice, you get a powerful B&D-built motor, custom-made for the tool it drives . . . streamlined design and perfect balance for easier handling . . .

and top-quality construction features for which Black & Decker is famous! Ask for a demonstration at your favorite Black & Decker outlet. Write today for detailed literature to: The Black & Decker Mfg. Co., 605 Pennsylvania Avenue, Towson 4, Maryland.

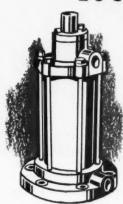


. . . use them to save

LOGAN FLUID POWER • DURABLE, DEPENDABLE SINCE 1916



LOGAN HYDRAULIC CYLINDERS



750 SERIES NONROTATING TYPE 7 STANDARD MOUNTINGS

Eight standard sizes from 2" to 8" diameter bore. Maximum operating pressure 750 p.s.i.

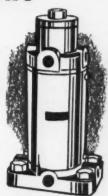
ROTATING "HR" TYPE

Seven standard sizes from 3" to 14" diameter bore. Maximum operating pressure 500 p.s.i,

ROTOCAST® SERIES 7 STANDARD MOUNTINGS

Sizes from 2" to 8" bore; any length stroke up to 8 feet as standard. Four piston rod end types. Operating pressures to 1500 p.s.i.

Consult Logan for your special heavy-duty, mill-type cylinder requirements



LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS



YOU DON'T "PUSSY FOOT" WITH A GRAY





Gains Longer Life, Greater Visibility, Safety and Simplified Design

It has been said that for a number of years very few improvements have been made in open hearth charging machines used in steel mills. Here too a consideration of Oilgear Fluid Power equipment led to some valuable and important progress.

The Morgan Engineering Company, a leading manufacturer in the field, decided that much could be gained by the use of oil hydraulics and designed its 10-ton charging machine accordingly. Morgan uses the following Oilgear Fluid Power equipment: a hydraulic pump with a volume of 60 gallons per minute at 1700 psi pressure; 2 hydraulic cylinders for the hoist; one cylinder for the peel clamping device; two 4-way control valves located near the pump operated in turn by two pilot valves in the operator's cab; and a cam operated relief valve on the peel clamping device.

The company gained the following advantages: on the hoist, the conventional large hoist motor with its reduction unit is eliminated giving the operator maximum visibility and of course surer operation. The hydraulic cylinders used eliminate the conventional crank motion used hitherto exclusively.

The peel clamping device is actuated by one hydraulic cylinder, felt to be a definite improvement. It was found that hydraulic clamping is adequate by itself and the usual locking device was eliminated. More important, hydraulic clamping prevents oscillation of the boxes

while the peel is being rotated and this prolongs the life of both peel head and boxes.

The cam operated relief valve is a safety measure, preventing the operator from lifting the box until the locking rod has been correctly located in the box head well.

Since this application has proved so satisfactory, the Morgan Engineering Company has applied Oilgear Fluid Power Equipment to other types of charging machines, to hot saws, inverted and portable strippers as well.

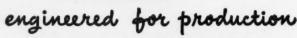
Designers should bear in mind the advantages cited above are in addition to the fundamental Oilgear advantages of flexibility, wide range of power, infinitely and steplessly variable speed range, unlimited ratios, smooth cushioned acceleration and shockfree hydro-dynamic braking, simplified and accessible hydraulic design well ahead of J.I.C. standards, a range of application from the handling of the most delicate and fragile webs up to the most massive power requirements. You are invited to submit your problem to Oilgear. It will cost you nothing to do so; it may prove to be one of the most profitable steps you have ever taken. THE OILGEAR COMPANY, 1569 W. Pierce St., Milwaukee 4, Wisconsin.



FOOTBURT

faster ..

for tool room or assembly line

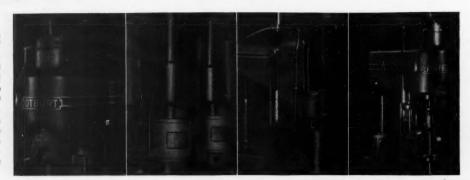


The choice of fine machine tools now will help you meet those new production schedules. Footburt Sensatives are built with the wide range of speeds and with power and sturdiness to drive cutting tools to their full capacity. They are built with the care and precision that will keep them accurate over a long period. Write, wire or phone for prices and delivery information.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building

No. 2 Machine with Back Gear • 12"
Overhang • ""Drilling Capacity in Steel
• Optional Speed Ranges • 185 to 2300 RPM • 280 to 3450 RPM • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.



Fengineered FOOTBURT production



Automatic Press for notching or perforating the strip before it goes into the forming machine, (2) the forming machine, and (3) another Yoder Press for automatic cut-off. The finished pieces from this line are then ready for assembly into window louvres or jalousies.

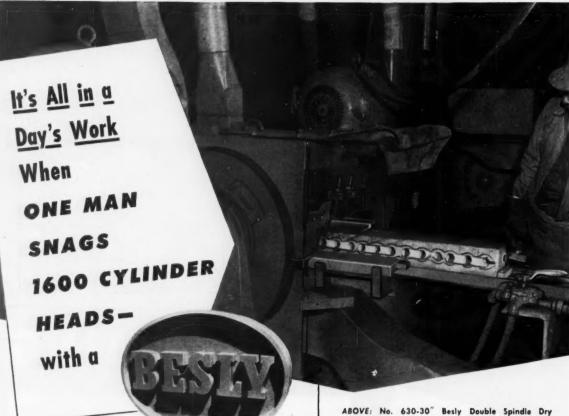
The know-how of the Yoder engineering staff is at your service in designing such multi-function production lines to meet individual requirements. Tell us about your needs. Yoder Book on Cold-Roll-Forming and auxiliary operations sent on request,

THE YODER COMPANY . 5504 Walworth Ave., Cleveland 2, Ohio

Complete Production Lines

- COLD-ROLL-FORMING and auxiliary machinery
- **GANG SLITTING LINES for Coils and Sheets**
- PIPE and TUBE MILLS-cold forming and welding





GRINDER

A Man and a Grinder Replace a
Crew of Hand Chippers to Avoid Holdups
in Feeding Automobile Engine
Production Line!

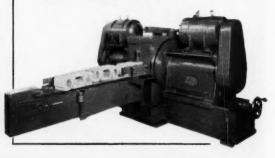
A Besly No. 630-30" Double Spindle Dry Grinder, attended by one man, now snags the fins from 1600 automotive cylinder head castings a day. Cast iron heads five to six inches thick, are conveyed hot from the foundry to the grinder operator who breaks off larger pieces of excess metal with a few hammer blows. The castings are then moved to a power-driven feeding fixture on the Besly Grinder, and fins 3/16 to 5/16-inch thick are ground off automatically with a single pass, producing clean, smooth, ready-to-machine castings.

It is production policy to meet the required cylinder head quota daily. With the Besly Grinder set-up, this manufacturer makes considerable savings in labor since a hand chipper crew is no longer required . . . and gets a better, more satisfactory job as well.

With changes in fixturing, the Besly No. 630 Grinder can be adapted to a wide variety of grinding operations, one of which may well speed and simplify your manufacturing process. Ask your Besly representative about this and other cost-cutting Besly Grinders for all needs!

ABOVE: No. 630-30" Besly Double Spindle Dry Grinder set up to grind cylinder head castings. Two $30'' \times 2'' \times 6''$ Besly-Titan Steelbac Abrasive Discs are driven through multiple vee-belt transmissions by two 25 HP, totally enclosed, fan-cooled, ball-bearing motors. Equipped with special exhaust hood and swinging arm wheel truing device. The continuous chain feeding fixture is motor driven through a worm and worm gear reducer. Special guide plates and spring-loaded hold down shoes accommodate the various castings.

BELOW: Besly No. 630 Grinder fixtured for smoothsurfacing tops and bottoms of concrete blocks.



BESLY-WELLES

Established in 1875 as CHARLES H. BESLY & CO. 112 Dearborn Ave., Beloit, Wis.

BESLY GRINDERS and ACCESSORIES . BESLY TAPS, DRILLS, REAMERS, END MILLS . BESLY-TITAN ABRASIVE WHEELS

WANT TO MILLIONTHS?



for MORE PRODUCTION BETTER SURFACE FINISHES **TOLERANCES IN THE MILLIONTHS**

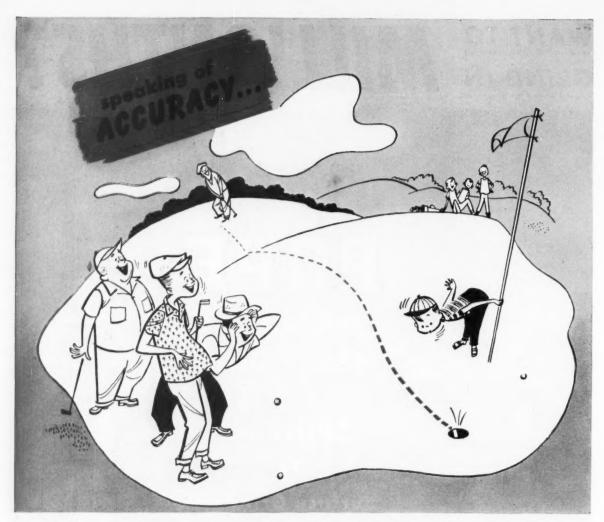
use these P-2500 Series Spindles. They have the extra power, bearing capacity and rigidity to do the job.

Write for new Catalog No. 58A

当の前望

261 RIVER STREET . HAVERHILL, MASSACHUSETTS UILDERS OF PRECISION SPINDLES

MACHINERY, May, 1953-145



"Jeepers! That putter of Mac's is as accurate as a



Legan No. 955
QUICK CHANGE GEAR LATHE
11" Swing, 1" Collet
Capacity, 136" Spindle Hole

Logan LATHE!"

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After making several basic adjustments that set the SWM-3 for a specific job, the machine practically works by itself. Just throw the switch to start welding. It's as easy as that. One simple knob is all you turn.

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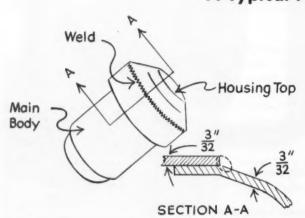
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Because of a high operating voltage built right into the control, the wire feed motor gets ample power for smooth, efficient operation.

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LINDE'S SWM-3 welds most metals fabricated commercially—aluminum alloys, stainless steel, carbon steel, deoxidized copper, Everdur, and aluminum bronze. Butt, lap, fillet, or corner welds are made in these metals from 16 gauge thickness upward.

This steel compressor housing is now being fabricated with Linde's new SWM-3 machine for sigma welding. Lap welds in the ½-in. material are made at 55 in. per minute. Current is 380 amp. dcrp, using ½-in. welding wire.

^{*} Initial letters of Shielded Inert Gas Metal Arc.

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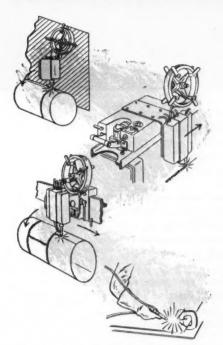
It handles 1/32, 3/64, 1/16, 3/32, welding wires

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Set up the welding head on a wall, post, or vertical bracket... Move the work to be welded beneath it. You can use the SWM-3 for many jobs in this position—it will handle four different sizes of welding wire.

GIVE IT MOTION

Mount the welding head on the OXWELD CM-37 tractor-type machine carriage . . . The SWM-3 will make longitudinal welds in cylinders, or butt, lap, and fillet welds in aluminum and stainless or carbon steels.

COMBINE BOTH SETUPS

It's just as easy to mount the SWM-3 on the Oxweld OM-48 side beam carriage: Use it for making longitudinal welds in any part. Stop the unit, revolve the work, and you can make circumferential welds in the same part—without changing the setup.

OR, USE IT MANUALLY

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150-MACHINERY, May, 1953



By LORING F. OVERMAN

Clearing Away the Road Blocks

FOR the first time since the outbreak of the Korean affair, the American industrial machine is being permitted to venture onto the business highway without having a government observer on the front seat beside the driver. In late March, the last of the price controls were removed. On April 1, the Controlled Materials Plan was relaxed to permit suppliers to accept unrated orders provided that filling them did not interfere with defense production.

On June 30, the Controlled Materials Plan will end, to be replaced by a more or less simple "Defense Materials System" of channeling steel, copper, aluminum, and stainless steel to the military. Civilian industry will operate without priorities assistance. Defense agencies and the Atomic Energy Commission—the only customers given preference under the new DMS—will be permitted to extend their rating symbols to the producers of components.

"Where We Came In"

In effect, the Spring of 1953 is somewhat of a "this is where we came in" period. Washington again appears to be trying to look at the military program objectively and realistically. Its "reconsidered judgment" is that, barring unexpected emergencies, the military program amounts to about 20 per cent of the economy, and that it should be treated accordingly. A real effort is being made at the Pentagon—at least at the Administration level—to trim the program down.

These efforts are being greeted with loud protests in some quarters, for it is inevitable that tightening the screws is bound to pinch some toes. In the machinery field, for example, defense output is dropping and orders for civilian use have not kept pace. Machine tool shipments from 350 reporting plants in October totaled 8761, but the score for January had dropped to 7149, according to the NPA Metal-Working Equipment Division.

Executives of the Division, although uncertain as to the status of the National Production Authority itself after June 30, are still confident that plans will be completed for an orderly readjustment of the machine tool industry. They also feel that cutbacks will include arrangements to provide for a continuous flow of

production of all types likely to be needed in an emergency.

\$27,000,000,000 Capital Outlay

Considerable encouragement is taken from a joint announcement of a capital spending survey conducted by the Commerce Department and the Securities and Exchange Commission. They report that American businessmen will spend a record \$27,000,000,000 on new plant and equipment in 1953. This would be \$500,000,000 more than 1952, the previous record high, and \$1,500,000,000 more than was spent by business for plant and equipment in 1951. The new survey reverses a previous estimate that business capital expenditures this year would be about \$500,000,000 below the 1952 figure.

Public utilities plan outlays 14.4 per cent higher than last year, and manufacturers' outlays of \$12,000,000,000 will about equal last year. Outlays by railroads will be down 7 per cent.

THE interesting thing about current efforts to read the future of the machinery industries is the fact that American ingenuity possesses the surprising knack of finding ways to pull itself out of difficult situations if given half a chance. Perhaps the following are straws in the wind:

First, the help wanted columns of metropolitan papers are pleading for engineers and draftsmen for three types of work—nuclear, electronic, and aeronautical. Such demands for manpower point toward expansions still in the drawing-board stage.

Second, those behind the scenes in the nuclear field keep hinting that research in the atomic sciences is uncovering secrets as amazingly constructive as the A-bombs are terrifyingly destructive. Automobiles "powered for life" are said to be beyond the dream stage. The success of an atomic-powered submarine will suggest other marine uses. A pilot plant has already produced enough atom-generated power to supply fifty fiverroom houses.

Stiff Climb Ahead

While it is encouraging and sometimes inspiring to probe the future, the present requires a steady hand on the wheel. And a firm foot on the brakes. Typical of the new caution functioning in Washington is the fluctuating status of the Air Force heavy press program. The \$389,000,000 program of building seventeen forging and extrusion presses capable of exerting pressures up to 50,000 tons has had many ups and downs since its inception. The Air Force contends that the presses, all of them, are necessary to maintain "leadership in design, development, and production of conventional and nilotless aircraft and rockets."

Opponents of the program characterize the project as experimental and extravagant in scope. They have been predicting that much of the program would fail to survive the Administration's economy drive. But the Pentagon has announced that the program "has been reviewed and will proceed as now constituted." The statement did not make it clear whether "as now constituted" meant "as originally planned."

A NOTHER key to current Washington thinking as it affects military procurement and government supervision is to be found in discussions of proposed standby controls of prices and wages. Chairman Jesse P. Wolcott, of the House Banking and Currency Committee, was firm in his conviction that Congress will not vote standby economic controls or "freeze legislation" unless the President specifically asks for such power.

"In an Administration pledged to a retrial of the American system of free enterprise, I can see no earthly reason for the type of power some are seeking to bestow upon the President," said Mr. Wolcott. "Even if we were subjected to another sneak attack at a time when Congress was not in session, I feel certain that by noon on the day following such an attack, modern transportation would deliver a quorum of the Congress to act quickly on emergency legislation. Any changes in prices during such a short interim period could be handled by means of rollbacks.

"To enact such standby or freeze legislation when there is no demonstrable need for it would defeat the stated purpose of such laws—the curbing of inflation. Unless someone can convince me that I am the only one out of step in viewing these proposals for economic controls, I can say that my crystal ball shows no signs of such legislation at this session of Congress."



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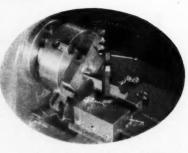
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HARDINGE BROTHERS, INC., ELMIRA, PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

Let's Pull Together Or We'll Pull Apart

OMMON sense tells us that management and labor would both benefit by working together for industrial peace rather than pitting their strength against each other. A mutual interest in universal prosperity should provide the basis for cooperation toward that end.

Labor leaders who look first to the real welfare of rank-and-file union members understand these facts, and a considerable number have backed up their ideals with correlating actions. Unfortunately, there are all too many who are more concerned with expanding their personal influence and attempt to do so by magnifying class antagonisms.

Congressional hearings are now being held in Washington with a view to eliminating any inequities in the Taft-Hartley Act that may be detrimental to the best interests of the working man. The presidents of the two biggest labor unions have appeared before committees and have advocated changes which admittedly would amount to repeal of the Act. They completely ignored the fact that the Republican platform last fall called for modification of the law and that the losing party pledged repeal. The voters decided the issue in the presidential election.

There has always been a certain amount of hypocrisy in attacks on the Taft-Hartley Act by labor leaders and certain politicians, and presumably the end is not in sight. Recently, Senator H. Alexander Smith made a noteworthy speech in which he advanced sound principles as a satisfactory foundation for a fair labor law. Four of them were expressed as follows:

That strong and responsible labor unions are a necessary, valuable part of our capitalist democracy.

That collective bargaining between free labor unions and private management is the best way to solve disputes over wages and working conditions.

That labor's right to strike is a fundamental right in our democratic capitalism

system.

That the major role of the Federal Government in labor-management relations should be to encourage wider cooperation between labor and management in improving working conditions and employment security, and in developing between them their own codes of fair practices.

Labor leaders applauded these ideas but took strong exception to Senator Smith's fifth principle:

It is the responsibility of the Federal Government to protect the industrial worker and his family, as free American citizens, from exploitation by either management or labor organizations.

In other words, labor leaders want no restrictions on their authority even though their actions may be detrimental to individual union members and to the country as a whole.

One of Stalin's fondest hopes was to see the United States go into another economic tailspin, and his followers here have always been zealous in fomenting grievances and disputes between management and labor with this insidious objective in mind. Certainly the last thing that the Communists would like to see happen would be for labor and management to pull solidly in the same direction.

There are bound to be industrial disputes, but let us never forget the fundamental fact that management cannot exist without labor or labor exist without management.

Charles O. 7



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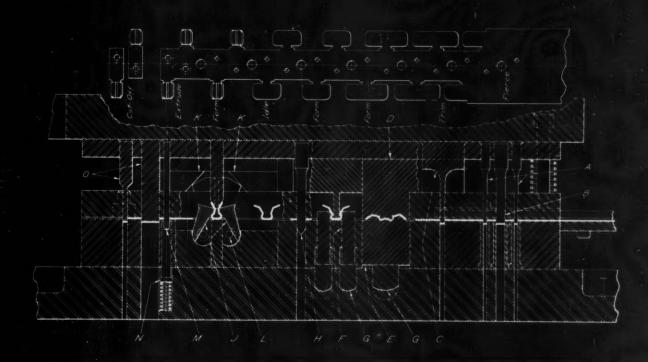
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Cost-Cutting Dies

By PETER S. TOBIAS, Supervisor of Tool Design, and CARL ERICKSON, Technical Foreman, Punch Press Department Minneapolis-Honeywell Regulator Co.

Minneapolis, Minn.

ORE than 20,000 different stampings are required for the over 8000 types of control instruments manufactured by the Minneapolis-Honeywell Regulator Co. Many of the stampings are close-tolerance parts made from various materials. About \$7,500,000 has been invested in dies for the production of these stampings. The lack of large-volume demand for any one part has limited the possibilities of die design, and has required ingenuity on the part of the tool designers. A few of the most oustanding dies employed for producing control instrument parts will be described in this article.

A seven-station progressive die—shown in position on a Verson 87-ton press in Fig. 1 and disassembled on a bench in Fig. 2—produces thermostat dials at the rate of forty-five per minute. The dials, stamped from 0.050-inch thick by 1 %-inch wide steel coil stock, were previously made in single-station dies on five presses. In the progressive die, the stock is fed from right to left. At the first station, a pilot hole \(\frac{1}{16} \) inch in diameter is pierced in the center of the strip. A punch located between the first and second stations trims nearly half the periphery of the blank while it is at the first station, and the other half when

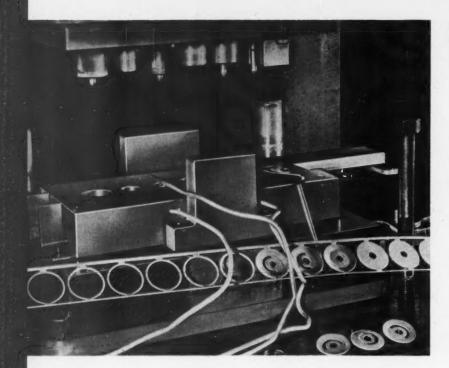


Fig. 1. Thermostat dials, seen at lower right, are produced at the rate of forty-five per minute on the seven-station progressive die here illustrated.

the blank has been fed to the second station. A pilot-pin enters the pierced center hole as the part is being blanked at the second station.

At the third station, thirteen calibration notches, ½6 inch long by 0.015 inch wide and

00000 X

0.010 inch deep, are stamped in the metal. The notches, spaced 12 degrees apart, are formed by a flat punch that presses the metal over the embossed die. A pin also enters the pilot-hole at this stamping station. The thermostat dial blanks are formed into the required saucer shape at the fourth station by a solid punch and springloaded, concentric ring type die. Mounted in the bore of this die is another punch for forming a chamfer in the bore of the blank.

A semicircular slot (1/8 inch wide and having a radius of 7/16 inch) that provides an opening for the thermostat indicator point is pierced in the blank at the fifth station. Another pilot-pin enters the bore of the work-piece during this operation, and the pierced blank is shed from the punch by the stripper plate. Since the overall height of the bowed dial must be held within plus or minus 0.003 inch, the blank is re-formed and flattened at the sixth station. Serrations forming included angles of 90 degrees and 1/64 inch deep are cut around the entire periphery of thermostat dial, thus severing it from the strip, at the seventh and final station. The completed dial is pushed down through the die by a springloaded ejector pin slidably mounted in the bore of the punch.

A particularly troublesome operation has been

Fig. 2. Punch and die used for producing thermostat dials in the set-up shown in Fig. 1. Completed dials are seen at lower left.

the drilling of two in-line pivot-pin holes, only 0.029 inch in diameter and 15/32 inch apart, through the 0.032-inch thick lugs of a stamped brass snap-switch lever for the armature of a sensitive control instrument. Since the two holes must be maintained in-line within plus or minus 0.001 inch and at 90 degrees from the center lines of slots in the ends of the lugs within 15 minutes of a degree, drilling of the holes was difficult and scrap losses were high. Now, by piercing the two pivot-holes simultaneously with the cam-actuated precision die shown in Fig. 3, production has been greatly increased, costs have been substantially reduced, and scrap is practically eliminated. The die is mounted on a Bliss 22-ton press, and is capable of piercing 1000 parts per hour with hand loading.

The stamped brass lever A is placed on dieblock B, three locating pins projecting from the top surface of the block entering previously punched holes in the work-piece. As the press ram descends, a spring-loaded pressure pad C clamps the lever against the die-block. Simultaneously, wedge blocks D acting on the tapered back faces of cams E cause the cams to slide toward each other. Punches F, which are sup-

ported in stripper blocks G, and punch-holders H, which are mounted on the front faces of cams E, are forced through the lugs of the brass lever, thus piercing the required holes. The lever lugs are backed up by replaceable die-plates J which have 0.032-inch diameter clearance holes for the punches.

As the press ram rises, cams E are returned to their original positions against stop-pins K by the action of compression springs L, thus withdrawing the punches from the work. Slugs from the pierced holes fall down through a central hole in the die-block, and the completed work-piece is lifted from the die by a blast of compressed air.

Wiper blades for the potentiometers that are used in aircraft automatic pilots are stamped from 0.006-inch thick by 2 $\frac{3}{32}$ -inch wide phosphor-bronze by means of the four-station progressive die shown in Figs. 4 and 5. This die is mounted in a Bliss 22-ton press, and completes 128 blades per minute. At the first station, the bronze strip is pierced to form the V-shaped profile of the wiper blade with punch A, two elongated holes (0.101 inch wide by 0.358 inch long) with punches B, and two $\frac{3}{32}$ -inch diameter

Fig. 3. Cam-actuated precision die simultaneously pierces two pivot-pin holes in brass lever at rate of 1000 per hour.

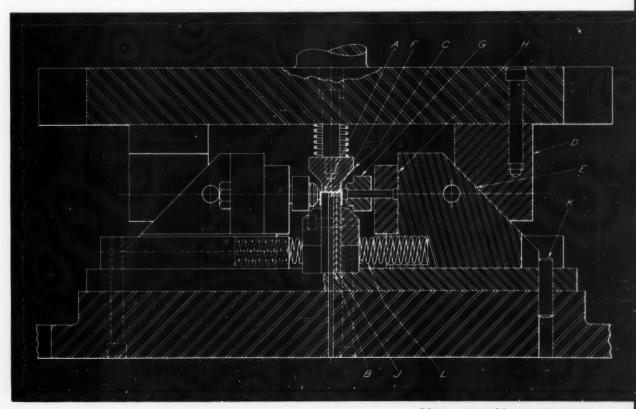
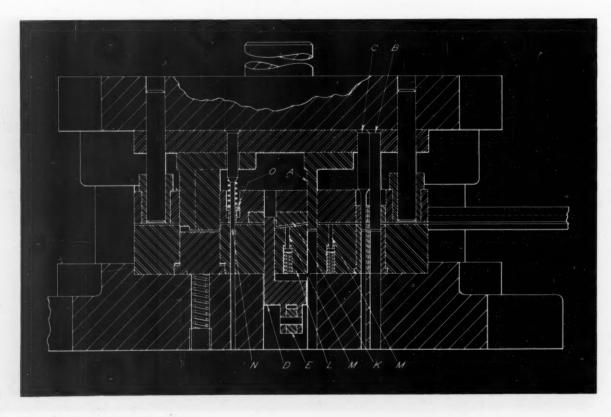




Fig. 4. Potentiometer wiper blades for aircraft automatic pilots are stamped from 0.006-inch thick phosphor-bronze in this progressive die.

holes for lift pins with punches C. Also, one edge of the strip stock is notched at this station to facilitate indexing when the stock is advanced 1.050 inches per press stroke.

After the stock has been indexed to the second station, reinforcing ribs are formed by bending the edges of the blank upward. This is accomplished by means of a forming block D that is lifted by a rocker arm E. This arm pivots about pin F when rod G is depressed by stud H. and is returned to its original position when the press ram rises due to the action of spring J. During forming of the reinforcing ribs, the blank is overbent downward between punch K and die L so that it will be flat after forming. Spring-operated lift-pins, shown at M, lift the part from the die after forming. The third station of this die is idle. At the fourth station, the wiper blade is cut to the required shape and severed from the strip stock. During the cutting off operation, the blade is located by means of the two pilotpins N that slide in spring-loaded stripping sleeves O.



Contact blades for electrical relay boxes are produced on the eight-station, duplex progressive die shown in Fig. 6. This die is used on a Verson 87-ton press that operates at forty-five strokes per minute. Since two blades are produced per press stroke, a production of 5400 blades per hour is possible. Coiled copper strip stock, 0.050 inch thick, is employed for these parts.

With the stock being fed from right to left through the die, the strip is successively pierced, trimmed, formed, extruded, and cut off. A hole is pierced in each blade with punches A, as seen in the heading illustration, and a pilot hole is pierced in the center of the strip by punch B, at the first station. Punches C trim two blanks at the second station; and the blanks are partially formed between punches D and dies E at the third station, and between forming pins F at the fourth station. As the press ram descends, dies E and forming pins F are raised by rocker cams G.

Station 5 is idle, but pilot-pin H enters the previously pierced hole in the center of the strip at this point in the die. Forming of the contact blades is completed at the sixth station by clamping the blades between jaws J. The jaws (fitted into slots milled in the die-block) are rocked into forming position by cams K and, when the press ram rises, are returned to their original posi-

tions by the action of compression springs. Pins L retain the jaws, but sufficient clearance is provided between the pins and the holes in the jaws so that the jaws bear only on the slots in the die-block.

At the seventh station, punches M extrude the previously pierced hole in each contact blade. Spring-loaded lift pins N raise the extruded parts from the die. The completed blades are cut off from the strip stock by punches O at the eighth and final station of this duplex progressive die.

The rocker arm arrangement for lifting the forming block in the die described in Fig. 5 was superseded in subsequent die designs with a rocker cam that does not require a pivot pin. This improved design is used in the progressive die shown in Fig. 7, which pierces, trims, forms, and extrudes the two holes in thermostat terminals. The terminals, made from 0.036-inch thick brass strip stock, are produced at the rate of 350 per minute on a Diebel 5-ton automatic press.

As can be seen from the stock progression, the brass strip is pierced by punches A at the first station, and trimmed to the required contour by punches B at the second. During trimming, two pilot-pins C enter the previously pierced holes in the blank. An interesting feature of this operation is that no scrap is left between adjoining

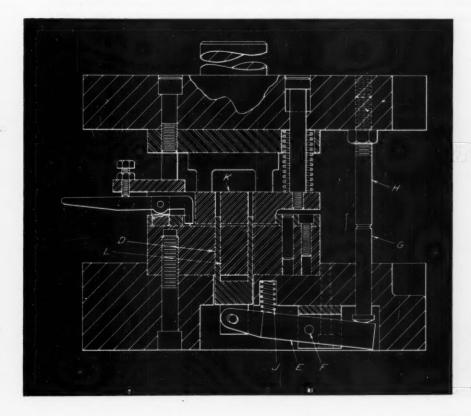
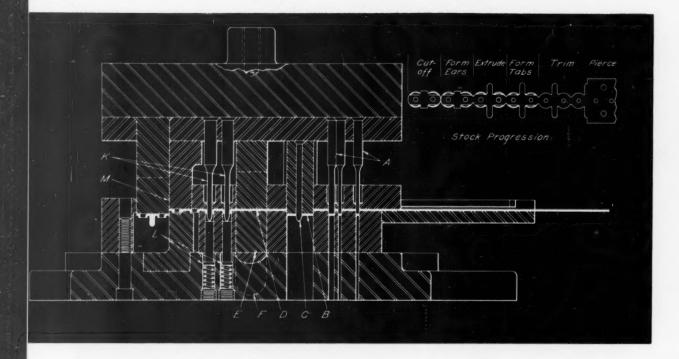


Fig. 5. (Across two pages)
Sectional views of die
shown in Fig. 4. Edges of
the blank are bent upward by the rocker armactuated block (D) to
form reinforcing ribs.



work-pieces. This is possible because slight projections at the ends of the thermostat terminals are not objectionable, and substantial stock savings are the result.

Four tabs—two on each side of the centrally located ears on the terminal blanks—are bent upward to an angle of 30 degrees at the third station. This is accomplished by clamping the tabs between form-blocks D and E. Form-block E is raised by cam F, which is rocked by the downward movement of plunger G and rod H. The cam and the form-block E are returned to

their original positions as the press ram rises by the action of spring-loaded pins J.

Punches K, at the fourth station, extrude the two holes previously pierced in the thermostat terminal. The extruded part is lifted from the die by spring-loaded plungers L. At the fifth station, the two ears on each terminal are bent down through an angle of 90 degrees by punch M; and at the sixth and final station, the completed part is cut off from the strip stock and blown from the die.

Extremely precise tolerances—plus or minus

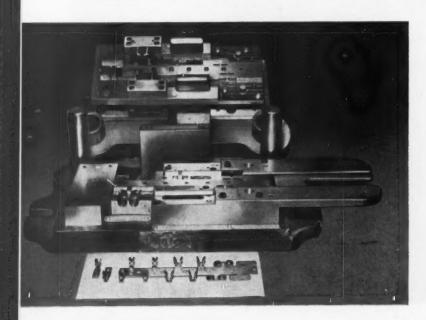
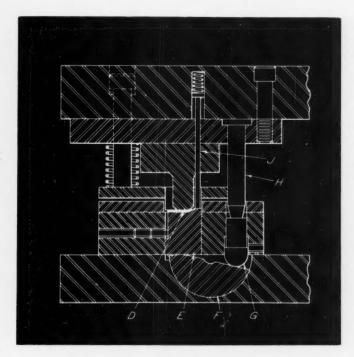


Fig. 6. Eight-station, progressive die pierces, trims, forms, extrudes, and cuts off centact blades at rate of 5400 per hour.



0.0005 inch on most dimensions—have to be held when stamping stator laminations such as the one shown in Fig. 8. By employing the carbide die seen in Fig. 9, close tolerances are effectively maintained, and long die life is obtained before

resharpening is necessary. With this die, the laminations are produced two per press stroke from 0.025-inch thick steel strip stock. Mounted in a Henry & Wright 60-ton dieing machine operating at 200 strokes per minute, this die is

Fig. 7. (Across two pages) In this die for piercing, trimming, forming, and extruding thermostat terminals, rocker cam (F) lifts form-block (E).

capable of producing 24,000 laminations per hour.

The blanking portion (right half) of this two-station progressive die was made from six sections of solid carbide, A to F inclusive, which facilitated surface grinding of the required contours. Mating faces of these die sections were lapped to permit close fitting assembly (indiscernible to the eye) without setting up strains in the carbide. In order to accurately hold the stator laminations to the required close tolerances, no back taper or draft was provided on the sides of the die openings.

With this design, the laminations cannot be pushed through the die, and the blanks are pressed back into the strip stock by spring-loaded pressure pads G. The blanks are moved in the strip to the second station, where hardened and ground tool-

steel punches and dies H and J, respectively, are used to remove the blanked laminations from the strip stock and push them down through the dies onto stackers.

A cutting clearance of only 0.0012 inch per

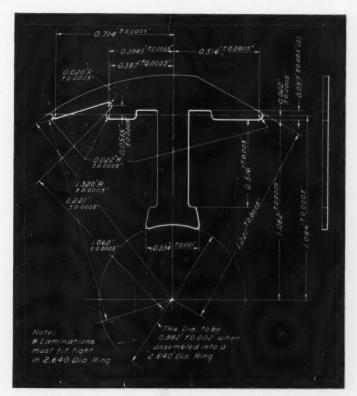


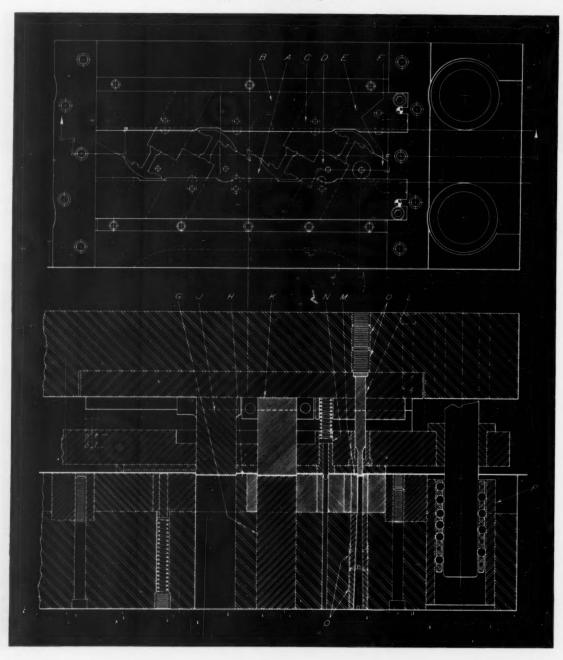
Fig. 8. Stator lamination stamped from 0.025-inch thick steel strip stock on the two-station progressive die shown in Fig. 9.

side is provided between the carbide form punches K and die sections A to F, while the steel punches J operate in die openings 0.005 inch larger than in the first station. In fact, the only reason for making the steel die openings of the same outline as the laminations is to prevent deforming the fragile work-pieces. A maximum clearance of 0.015 inch is provided in the open-

ings through the die-shoe so that the parts will fall properly onto the stackers.

Carbide pilot-hole punch L operates in a carbide die bushing M. The spring-loaded pilot-pin is shown at N. Adjusting screws O provide for lowering punch L and raising bushing M after resharpening. A ball-bearing die set P is employed to insure accurate operation of this tool.

Fig. 9. Carbide is employed in this progressive die for the six die sections (A) to (F), inclusive, the two form punches (K), pilot-hole punch (L), and die bushing (M).



DIMENSIONS and TOLERANCES

FOR MASS PRODUCTION

The first article in an extended series that will propound new conceptions in the specification of



dimensions and tolerances for mass production operations. Written by an eminent authority on interchangeable manufacture, the proposals to be advanced in these articles would remove many uncertainties prevalent in present-day practice.

By EARLE BUCKINGHAM

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Dimensions and Tolerances for Mass Production

Toluced on mechanical drawings shortly after the turn of the century. Their need was made apparent because of a change in the general organization of most manufacturing plants at that period. Until the late 1890's, the contract system of manufacture was quite common. Under this system, the contractor agreed to manufacture, at a specified price, certain units or sub-assemblies of the product. Unsatisfactory parts or sub-assemblies were returned to him without payment. Either they served their purpose in the assembled product or they did not. Their performance in the assembly was the criterion or decisive test of their quality.

Under this contract system, the contractor and his assistants had to plan the sequence of the machining operations; design and make all necessary special equipment and cutting tools; set them up and supervise the operation of the equipment; and assume full responsibility for the results.

When this system was discontinued, many of the contractors were retained as superintendents or foremen of manufacturing departments with a fixed salary. The emphasis appeared to be placed on volume of production. The foreman had no financial stake in the quality of the product. In many cases, this change in the form of the organization also included the collection of similar manufacturing equipment into specialized departments.

Under these circumstances, a given part might pass through several departments before it was finished. In case of a faulty product, it was difficult to determine which department had made the error. The new conditions led to the introduction of the inspector. Since no inspection practice had been developed, many of the inspectors seemed to feel that their major purpose was to find fault. With fixed dimensions on the detail drawings, and notes relating to burrs and the nature of surface finish entirely absent, many controversies inevitably arose between the foremen and the inspectors about what was acceptable and what was not.

Early Use of Tolerances—To meet this situation, the suggestion was made that each dimension should be given with an allowable variation, or tolerance. In many cases this was done by giv-

ing a plus and minus tolerance on the dimensions of every machined surface. The results in practice were far from satisfactory. It soon became evident to those close to this problem that the whole subject was a complex and difficult one to master. Different manufacturing plants began to develop different practices. Eventually, limit gages began to make their appearance. Even so, inspection conditions were chaotic.

At the same time, the size of many plants increased greatly and the responsibilities for various phases of the work were spread over an increasing number of individuals and departments. The interpretation of the true meaning of the tolerances on dimensions in product specifications created a three-cornered controversy among the draftsman, the production department, and the inspector. Each fought for his own interpretation of the subject—a meaning for the dimensions and tolerances that would make his own part of the work simplest to carry out.

Unfortunately, most of this took place beyond the ken of the policy-making group of the organization. The general managers, development engineers, and many others in the head office were not fully aware of the seriousness of the situation. These matters were just other production difficulties or "headaches" that were up to the production group to work out for themselves.

Dimensional Problem Still Remains—During the period from 1915 to 1920, the impact of enormous orders for munitions—first from abroad and later from at home—forced a marked advance in the technique of handling these problems. Different plants making the same products had to meet the same inspection procedures. This advance has continued since then, but even today the problem is far from being completely solved. Several standards committees are now working on it, but they can publish only the material that has been generally agreed upon. Many controversial factors are still a matter of debate.

This text is the attempt of one individual to state the problem of dimensioning with tolerances for mass production—with its impact on production design, tool design, gage design, production, and inspection—and to suggest definite methods or practices to meet the situation. No claim is made that it offers the best or final solution, although eventually some adequate solution

must be found. Whether or not the specific treatment outlined here is generally accepted, some equivalent solutions must be adopted.

The Design

Stages in Product Design—The problem of creative or experimental design is much the same whether the final product is to be restricted to a small quantity or is to be manufactured in large quantities over an extended period of time. It starts with the mental conception of some function or service to be performed. No product is ever made for itself alone. It must meet some need or gratify some desire of the customer. The idea then takes more concrete form, first as sketches and drawings, and finally in metal as an experimental mechanism. The first model always undergoes many changes to correct faults and to improve its performance.

The major effort at this point is to construct a mechanism that will work. Consideration of the problems of manufacture receive little or no attention during this phase of the development other than the designing of the individual components so that they can actually be made.

Given a successful experimental model that is to be produced in quantity, a choice must be made between two alternatives. In one case, the existing manufacturing equipment must be altered to fit the conditions entailed by the specific design, and special machines must be designed and built to meet all conditions that the existing equipment will not handle. Any special machine will involve extensive experimental work on this manufacturing equipment before such equipment is in good operating condition. In the other case, the detail design of the product itself must be altered to fit the existing processes and equipment. At times, this may be an almost impossible task for some of the more critical features of the product. The final solution is a combination of the two procedures-most of the details are altered to fit the existing equipment, while special machines may be needed for a few critical elements. This redesign to facilitate manufacture is called the Production Design.

Inspirational Versus Analytical Design—Machine design is the combination of two types of effort, inspirational and analytical. Inspirational design cannot be taught. It can be developed only when the designer possesses an inherent aptitude for it. Inspirational design alone will create many new products, but most of them will not be practical. Analytical design is the rigorous examination of existing machine elements

and their combinations. This can be taught and is the essence of machine design and its supporting subjects which are taught in technical schools. Of itself it will make many improvements and refinements in existing designs, but it will never develop anything radically new.

Creative machine design as a whole is the blending of the two: the new design is forged into general form by the heat and impact of the inspirational effort and is tempered and refined by the cold reasoning of the analytical effort. Functional design is largely inspirational with only enough of the analytical to keep it in the range of the practical. Production design is largely the analytical with sufficient of the inspirational to exploit the full possibilities of the original idea.

A pertinent analogy is that of creative writing. The inspiration or "divine spark" is something born in the writer. It cannot be taught. The analytical aspect involves the structure of language, the use of vocabulary, and the study of existing literatures. This is all that can be taught. Great writing requires both elements. Creative writing consists in the initial reduction of thoughts into words and their studied arrangement into the final form.

The Experimental Design—In the final analysis, all engineering calculations are approximations and estimates. They are a combination of the theoretical and the empirical. In any given case, the problem can be carried only so far on paper. Sooner or later the point is reached where one must "try and see." With experience and increasing experimental information, many problems can be carried further on paper than was at first possible, but the final answer to any new problem requires the experimental values to complete it.

The completion of the Experimental Design often requires much preliminary work before the solutions of many of its problems can be reached. Many experimental engineering departments have their own machine shop and research laboratory to meet this need. These research laboratories, in turn, are constantly developing new information so that the analytical work can be carried further before the actual experimental work is required.

The experimental design of a new product, or of a new feature for an old product, may require several years before it has been perfected and tested adequately to fit it for production. For example, the experimental design of a new element for an automobile that has just been started today may not be accepted for production until eight or ten years from today. At the time that the finishing touches are being made on the new features for next year's model car, the experimental engineering department is also busy with other experimental projects, many of which may never be adopted for production. Hence it is obvious that little attention can be given in the Experimental Design to the many detailed and seemingly petty problems involved in the successive machining operations on individual components that must be performed in mass production. Actually a Production Design is needed for this purpose.

The Production Design-Many organizations fail to recognize the twofold nature of designing for mass production. They start production from the final experimental or functional design. As a result, the first few months of actual production require many changes in details of design and in the special manufacturing equipment. At times, all of the initial shipments to customers must be returned for correction or replacement. When reasons are given on change slips for most of these changes, they read: "To facilitate manufacture." When an adequate Production Design is made at the start, most of these shortcomings will be detected before production begins. One engineer in charge of Production Design defined his duty as that of catching mistakes before they happen.

As already noted, Production Design is essentially a critical study of the details of a product to determine the essential features and conditions that must be maintained to insure an adequate product. The greater part of the work consists of minor alterations in these components so that they can be most economically manufactured. At the same time, every effort must be made to improve the performance of the finished product. All existing functional advantages must be retained or improved. "Better and cheaper" must be the watchword here, with the accent on the "better." Given sufficient thought, care, and persistence, this goal can be reached.

Today, in those plants where this twofold nature of design for mass production is recognized, the first step after the acceptance of a new experimental design for production is the redesign of all detail parts to facilitate their manufacture. At this point, the attempt is made to anticipate and correct for all future manufacturing difficulties. Next, the specific manufacturing operations are scheduled. Often difficulties overlooked in the first attempt at Production Design become apparent here. These conditions are corrected. Following this, tool and gage de-

signs are started. Here again some overlooked problems are apt to come to light. These are also corrected promptly.

Even after production is under way, problems arise continually. Many of them are solved by proper changes in the Production Design. The Production Design is never completely finished as long as the product is being manufactured.

Use of Manufacturing Models—Questions will often arise about the effectiveness of proposed changes. There is no doubt that the changed design will be more economical to manufacture, but will the final results be adequate or better than the original design? The only conclusive answer to such questions is "Try and see." Often the question can be answered by a comparatively simple experiment.

When the first phase of the Production Design is completed, it is a good practice to make several manufacturing models to this design. Since tolerances are an important feature of the Production Design, more than one model is needed to prove the effectiveness of both the tightest and the loosest fit conditions. This is an expensive practice but, considering the cost of all the special tooling, it is a cheap form of insurance.

In addition to the proving of the Production Design, such manufacturing models can serve other useful purposes after they have proved the adequacy of the original Production Design. Some may be operated to obtain needed information on their probable performance in continued service; overload and continuous running tests will give information on wear in service and probable useful life; and so on. By such means, many minor but troublesome operating faults can be found and corrected before the first units of the new product have reached the hands of the customers. In addition, one or two manufacturing models should be set aside to serve as functional gages to test the behavior of the first tool-made parts of the production. Otherwise, samples of all of the parts must be completed before they can be assembled and tested for actual performance in service.

The Drawing

Need for Adequate Detail Drawings—The requirements of the Production Design are rigorous. In common practice today they are far from being adequately met. For one thing, the detail drawings must give completely all of the dimensional information, with permissible tolerances, so that every operation on each component of the product can be made correctly without reference to anything other than the drawing of the spe-

cific part. The initial purpose of the detail drawing is to give all pertinent information available for the design of the special manufacturing equipment as well as for the control of all the initial production activities.

Production, once under way, makes available additional information. The detail drawing then provides a place to record as much of this experience as possible. The drawings of an earlier product serve as effective examples for the drawings of a new product. Therefore, only by keeping the drawings of current production upto-date can past experience be exploited consistently and definitely.

Language of Drawings—At the present time, with the increasing use of tolerances, the language of drawings is incomplete in many respects. There is now no common and consistent practice for the expression of tolerances and their application or translation into definite measuring and manufacturing equipment. The same drawing today is often interpreted quite differently in separate manufacturing plants. Again, certain essential requirements of the components of a product may be known, but there is no commonly accepted method or language by which they may be recorded.

As noted before, the purpose of the present text is to present this problem and to suggest a definite solution. The exact solution suggested here may need to be modified, expanded, corrected, or improved before it is generally acceptable to the manufacturing industry as a whole, but equivalent means must be substituted before a solution is reached. As far as possible, existing practices that seem adequate will be used. Where existing practices are inadequate or absent, new ones will be suggested.

Dimensional Specification Objectives—The primary objective of the production design and of the dimensional specifications for the component parts of a product is to insure one that will give the service desired. This service includes its operation, its assembly, an adequate length of useful life, and its maintenance. The performance of a product in service is the sole criterion of success. All other factors are means to this end. Any practice that interferes with this primary objective is wrong and must be corrected.

A secondary objective of the production design as a whole, and the primary objective of the dimensional specifications, is to facilitate the manufacture of the component parts. Yet even here the performance of the product must not be jeopardized in any way.

The application of tolerances to dimensions introduces many complications. A dimension, in itself, is a fixed value or a constant. The introduction of a tolerance makes it a variable quantity. A variable requires different treatment from a constant.

The essential purpose of manufacturing is to turn out a product that will meet some specific need. Each component part of this product has a definite purpose to fulfill toward this objective. In addition, it must be possible to manufacture this product as cheaply as possible if it is to be exploited to the greatest extent.

The object of the dimensional specifications of the design is to define accurately and completely the limits of parts and features of parts that will insure correct performance of the product and involve the minimum manufacturing costs. The dimensional requirements of every detail part must be definitely and completely given on the detail drawing without the need of reference to any other source. This dimensional information governs the design of the inspection gages and all of the other special manufacturing equipment that may be needed. It governs the procedure of the inspectors and that of the mechanics who set up and operate the manufacturing equipment.

When the design authority and the production unit are separate organizations, these drawings constitute the legal bases of the contract between the purchaser and the manufacturer. They are also the essential link between the designer and the manufacturers whereby the requirements of the former are conveyed to the latter.

Requirements of a Good Drawing—There is a clear need in the manufacturing industry for drawing requirements to be expressed in a common language, so that identical forms of statement shall always have the same meanings. It is essential that every drawing should

- 1. be correct;
- 2. be clear and unambiguous;
- be complete, containing in itself all the information necessary in order that both the manufacturer and the inspector may know from it precisely what is required; and
- 4. not call for tolerances so stringent that the work is impossible, or at any rate too difficult to manufacture and inspect on a basis consistent with the conditions which may be expected to prevail.

As noted earlier, there are two distinct phases of the Production Design: first, all possible revisions to improve the operation of the product;

DIMENSIONS AND TOLERANCES FOR MASS PRODUCTION

and second, all necessary and practicable revisions of features of components that will make for simpler and less expensive manufacture. In order to record and explain this information to the manufacturing and inspection departments, it is necessary to express geometric and dimensional information clearly, completely, and unambiguously.

Specifying the size and tolerance for any feature of a component is not enough. Each part has a definite purpose and its size or bulk must be such that its full purpose will be realized. The requisite dimensional conditions must be established by experience or by trial. Once they are determined, or even assumed for the purpose of making a start, they must be specified in unmistakable and definite terms. They must be so stated that anyone "skilled in the art" can, by means of specific measurement, demonstrate with certainty that the product or feature of a component does or does not meet the specifications. There must be no hazy region of uncertainty. Whether or not the dimensional specifications are correct, there must be no doubt about the actual dimensional conditions that are specified. If the specifications themselves are incorrect, they can be corrected. If the method or language used to specify them is ambiguous, then no corrections are possible until the language itself has been made precise.

The present language of drawings as it affects the dimensions and tolerances is incomplete, ambiguous in many respects, and actually silent in regard to many dimensional conditions. Whether notes or symbols are used, a precise language with precise definitions is the first requirement of a clear and definite specification.

Types of Dimensions Used-There are three different kinds of dimensions needed on detail drawings. Constructional dimensions are needed to define geometrical relations. These never have tolerances applied to them and may never be measured directly in manufacture. When such dimensions apply to profiles or to positions, the general tolerance given to those features covers the permissible variations. In other cases, these dimensions may be followed by the letters CONS., when their constructional nature is not clearly apparent or if necessary to prevent misunderstanding.

Calculated dimensions are needed, at times, to establish some basic conditions from which some other dimensions are established. Such dimensions carry no tolerances and are never measured directly in production. All such calculated dimensions are followed by the letters CALC.

Limiting dimensions are needed to define machined or finished surfaces essential to the assembly and operation of the product. The limiting sizes, or the design size with a tolerance, must always be specified. These are the dimensions which must be measured directly in the course of manufacture.

Limiting Dimensions

Interpretations of Limiting Dimensions and Tolerances—The limiting dimensions themselves serve different purposes and must be considered under separate categories. Effective methods for their control in manufacture impose different treatments. But first of all it is necessary to agree about the fundamental meaning of the limiting dimensions on the detail drawings. The interpretation of these is still a controversial subject. Much of this difficulty can be traced back to the fact that no measurement is ever correct in an absolute sense. The probable errors of measurement may be of the order of a small fraction of a thousandth of an inch, but they are always present and always troublesome.

Many production engineers and mechanics argue that the whole tolerance should be available for the manufacturing department so that any variations in the sizes of the gages should be outside of the product limits, else the gage will reject parts that are within but close to either limit.

When the work is controlled by gages, the size of the product will follow them. No change in the machine set-up is made until the gaging indicates its need. In fact, where limit gages are used, the physical sizes and forms of the components will depend more upon the sizes, forms, and designs of these gages than upon the dimensional specifications on the component drawings. Thus a radical change in the design of a gage, without any change in the dimensional specifications, may require an entirely new choice and sequence of machining operations to produce the component part.

Another argument for making the sizes of the gages outside of the product limits is sometimes advanced. The claim is made, for example, that a 1-inch diameter plug gage will not enter a 1-inch diameter hole; hence the "Go" gage must be made somewhat smaller. The amount smaller may be another source of argument, but it must be something smaller in order not to reject the hole. The question as to the actual size of a hole is still a matter of some doubt. For all practical purposes, however, a 1-inch hole is one that fits

a 1-inch diameter plug gage. In addition, the persons who argue for a smaller size for the "Go" plug gage often contend that the "Not Go" gage for a hole should be made larger, or outside the maximum limit, because if it is made to size it will enter a hole at the maximum limit. Both arguments cannot be valid, but it appears to be impossible to convince such people that one contradicts the other.

This practice, nevertheless, is followed in many places; and the gage variations are outside of the product limits. If, however, the extreme limits of functioning parts are known, then the limits on the component drawings must be reduced by the amount of the gage tolerances and wear allowances. Yet it seems illogical to set up such conditions that any improvements in the accuracy of the measuring will reduce the actual working tolerances of the shop: but that is just what this practice does. The size of the work follows the size of the gages; and improvements in the accuracy of the gaging will keep the work closer to the reduced tolerance on the component drawings than was previously possible.

Still another interpretation of the meaning of tolerances is sometimes made. This one is primarily a matter of expediency. Expedients are often necessary, but should always be used as emergency measures only, not as standard practice methods.

The maximum metal sizes of mating parts or features are almost always the more important ones and are the ones most readily determined. These are the sizes that leave the most metal on a part. Experience or simple experiments will soon give the tightest condition of fit that will insure correct functioning for the new product. The minimum metal sizes that control the loosest condition of fit are often indefinite. In this case, not only the performance of the new product must be considered, but also its behavior when worn in service. Therefore the minimum metal size is often specified well inside the extreme limit of functioning.

In this practice, the variation in the size of the "Go" gage that is used to check the maximum metal limit size is kept within the product limits, because any variation outside of these limits makes for a tighter fit and soon leads to trouble. Then, in order to avoid arguments in the shop, the variation on the "Not Go" gage is placed outside the product limits. In this case, if the argument is raised that the permissible variation in the size of the "Go" gage is robbing the shop of some of its tolerance, it is pointed out that the variation in the size of the "Not Go" gage gives back all that is taken on the "Go" gage.

Limiting Dimensions Represent Inspection Gage Requirements-The only logical and defensible interpretation of tolerances is that the limiting dimensions on the detail drawings represent the requirements of the inspection gages. The tolerances specified cover all unavoidable variations. In other words, it must be possible to translate every limiting dimension into a definite design and size of an inspection gage. Hence these limiting dimensions represent specific tests with specific gages and all parts of the product that meet them must be adequate dimensionally to meet the use or service requirements of the product. To thus specify the gages by means of the dimensioning of the detail drawings in order to insure this result is no easy task.

Conditions Controlled by Limiting Dimensions
—Limiting dimensions on the detail drawings
of various components are needed to control the
following conditions:

- 1. conditions of bulk or size;
- 2. conditions of form:
- 3. conditions of position; and
- conditions of assembly, operation, or functioning.

The method used to specify the permissible variation or tolerance may need to be different for each of these conditions. Conditions of form or conditions of position treated in the same manner as conditions of size lead to confusion. Conditions of position must be controlled from definite datum surfaces. The same datums must be used for machining and gaging. Gages of size, gages of form, gages of position, and functional gages all have quite different characteristics and principles of construction.

The dimensions on the detail drawings also control many elements of the design of the special manufacturing equipment such as the cutting tools, jigs, and fixtures. The extent of the tolerance often determines the choice of the manufacturing processes that must be used to make the parts. Therefore it must be realized that the Production Design and the dimensioning of the detail drawings have a direct and most important influence on the economy of manufacture.

The detailed consideration of this whole subject will start in the next article with a study of the first phase of the Production Design.

Bending Hollow Rectangular



THE effective use of radar equipment requires that as clear and accurate a picture as possible be maintained on the cathode-ray tube screen. An important factor in preventing distortion of this picture is the condition of the inside of the rectangular tubing which connects both transmitting and receiving equipment with the antenna. Any obstructions, irregularities, or discontinuities result in distortion of the signals that travel along the inside of the tube. This presents certain difficulties when the tubing is bent or twisted to the desired shape for installation.

These difficulties were successfully overcome, however, by the Equipment Production Division, Raytheon Mfg. Co., Waltham, Mass., which is now bending substantial quantities of rectangular tubing in sizes ranging from 1/4 by 1/2 inch to 11/2 by 3 inches for radar installation. The success of the bending operation depends on the ability to support the inside of the tubing as it is being bent. This support is given by means of thin spring steel strips which have the ability to slip over one another as the bending progresses. The twisting operation is accomplished using dry sand as the supporting material.

Bends and twists that have been made employing these supporting mediums are shown in the heading illustration. Since these pieces guide

the microwave signals, they are called wave guides. A close-up view of a cut-away section through a right-angle bend is shown in Fig. 1. Although the bend is wrinkle-free and regular, some thinning along the outside and some thickening along the inside of the bend are apparent, but this does not prove objectionable, since strength is not a factor.

The material used for the fabrication of wave guides is either 90/10 commercial bronze or 2S aluminum alloy hollow rectangular tubing with a depth equal to one-half of its width. The accompanying table gives the nominal dimensions, wall thickness, and medium bending radii (measured to the outside surface of the inside portion of the bend) of the tubing used for fabricating these wave guides.

Minimum Bending Radii for Hollow Rectangular Tubing

Nominal Dimensions, in Inches					
Depth	Width	Wall Thickness	Minimum	Bending	Radii*
1/4 1/2 5/8 3/4 1 1 1/2	1/4 1 1/4 1 1/2 2 3	0.040 0.050 0.060 0.0625 0.0625 0.080		1/4 1/2 5/8 3/4 1 2	

Tubing at Raytheon

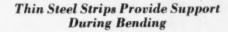
A high degree of smoothness of bends and twists in some applications of hollow rectangular tubing is of prime importance. This article describes the methods employed in bending and twisting hollow rectangular tubing with smooth, regular, and continuous inside surfaces in the fabrication of radar wave guides

By HARRY F. CLARKE

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It must be understood that these minimum bending radii values are the ones found in practice to give smooth unwrinkled bends employing the methods described.

The bend produced in a piece of tubing is usually made so that the plane of the bend either passes through the smaller or the larger dimension of the tube. If it passes through the smaller dimension, the resulting bend is referred to as an "easy," or "E" bend, and if it passes through the larger dimension, the bend is referred to as a "hard," or "H" bend.



Briefly, a tube is bent by placing a bunch of thin steel-supporting strips inside of it, bending the tube on the draw-bending machine, and removing the strips after the bend has been made.

The tube is first annealed, and then dipped in SAE 30 oil to provide lubrication for the insertion of the supporting strips. Two bunches of supporting steel strips are shown in Fig. 2. The one on the left is used in making "E" bends in 11/2- by 3-inch tubing. The one on the right is used in producing "H" bends in the same size tubing.

A vise is employed in guiding the tube around the bunch of strips, Fig. 3. The bunch is placed

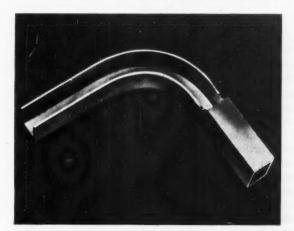
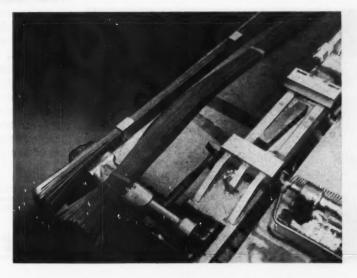


Fig. 1. (Above) Cut-away section of a wrinkle-free 90-degree bend. There is some thinning and thickening along the outside and inside walls of the tube, respectively.

Fig. 2. (Right) Two bunches of springsteel supporting strips used in bending rectangular tubing—the one at the left being employed in producing "E" bends and the one at the right, "H" bends.







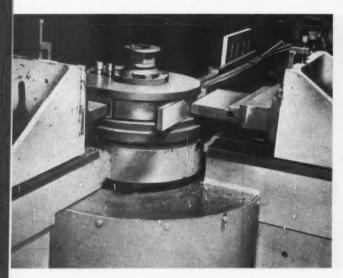


Fig. 3. Hand bench methods employing a vise and hammer are used to slip tube over a bunch of spring steel supporting strips preparatory to the bending operation.

in the jaws, as shown, the jaws then being tightened to make the bunch compact. Before the final tightening, the bunch is struck lightly with a hammer to make the top edges of all the strips the same height.

Each strip of the bunch is made of spring steel 0.020 inch in thickness and 0.008 inch smaller in width than the inside dimension of the tube into which it is to be inserted. It is interesting to note that in grinding these strips to the proper width a few at a time are rolled into a circle and placed with the edges in contact with a flat surface into a steel hoop. The steel hoop keeps the strips from unrolling and holds them firmly. The hoop containing the strips is now placed on a surface grinder and the strips are ground to the proper width.

Bending Rectangular Strip-Filled Tube

In bending the rectangular strip-filled tube, a Wallace No. 5 draw-bending machine is used. The strip-filled piece is placed in the machine together with the appropriate dies and blocks. Both sides of the movable pressure block which slides along the surfaces of the piece being bent and the pressure die are lubricated with grease to reduce the friction.

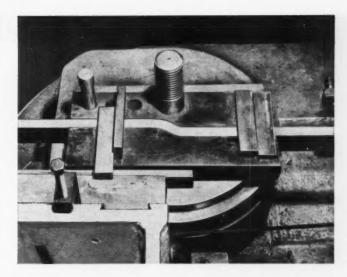
A completed "H" bend is shown in Fig. 4. The top portion of the bending form of the set-up in which it was bent is removed so that the component parts can more easily be seen. During the bending operation, the clamping die on the left is initially next to the pressure die which is on the right. The clamping die is moved up by hydraulic means until it exerts the approximate pressure necessary to prevent the tube being bent from slipping. The final tightening is done by hand by means of a large wrench and ratchet mechanism. The setting of the pressure die is done in a similar manner, first by advancing the die hydraulically and then making the final adjustment by hand.

Since the clamping die mechanism and bending form rotate as one unit to the left, the tube is wiped around the bending form under the action of the pressure die. The strips provide the

Fig. 4. (Center) Completed 90-degree "H" bend. Top portion of bending form has been removed to show tooling set-up more clearly.

Fig. 5. (Left) A completed 90-degree "E" bend shows the tooling and supporting techniques used on the draw-bending machine employed.

Fig. 6. Clamping die mechanism of this drawbending machine is used to produce the offset bend in the strip-filled tube by employing the press-bending principle.



proper support as the piece is being bent, and at the completion of the bending operation are held very tightly inside the tube. In Fig. 5 is seen the completed bend position for a 90-degree "E" bend. All of the component parts of the set-up have been left in place in this illustration.

Using the Draw-Bending Machine for Press-Bending

An interesting operation in which the drawbending machine is used as a press-bending machine is shown in Fig. 6. The draw-bending machine could not be used conventionally to make this type of offset bend since the two bends are so very close together. Instead, the clamping die mechanism of the draw-bending machine and a die are used. One portion of the die is fastened securely to the bending form. The other portion is positioned properly by means of guides welded to it and to the top of the first portion. The action of the clamping die mechanism as it advances and acts against the straight piece of strip-filled tube between the two portions of the die makes the tube conform to the die contour.

After bending, the bunch of strips is held tightly by the bent piece of tubing. The method of its removal is illustrated in Fig. 7. There are two groups of five supporting strips each that have small steel blocks welded to their ends. These steel blocks are gripped in the jaws of a hydraulic vise which is a part of the bending machine. A hydraulically actuated draw-bar, also part of the machine, moves the vise to the right on the grooved tracks, and at the same time removes the two groups of strips from the middle part of the bunch. With these two portions removed, the jaws can be used to grip the remaining blockless supporting strips and withdraw them easily in the same manner.

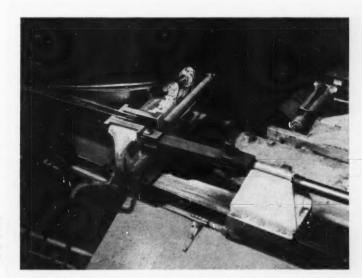


Fig. 7. Removing the supporting strips from the inside of a completed bend. Steel blocks welded to the ends of two inner groups of supporting strips are gripped in a vise and the strips are withdrawn by means of a draw-bar on the bending machine.

Fig. 8. Filling a tube with sand. The sand offers support during the subsequent twisting operation.

Sand is Used as a Supporting Medium in Twisting

Among the sample pieces illustrated in the heading illustration are some with twists. In making these, care must be taken in order to avoid the formation of any obstructions or surface irregularities on the inside surface of the tube. The tubes are annealed and then filled with sand. In doing this, one end of the piece is first plugged with a small piece of wood. Dry sand is poured in the tube by means of a special pitcher, as shown in Fig. 8. The sand is packed by striking the side of the tube lightly with a piece of wood or rubber mallet. When tightly packed, the opposite end of the tube is also plugged.

The tube is then placed in the jaws of an improvised torsion machine, the twisting and clamping components of which are mounted on a lathe bed. Fig. 9 illustrates the set-up used in twisting a 1/2- by 1-inch sand filled rectangular tube. The end of the tube on the right is securely held by a clamping arrangement. The mechanism on the left is a four-piece clamp inserted in a two-piece holder which, in turn, is made to rotate by means of a worm and worm wheel drive actuated by the spoked handwheel at the rear of the machine. The clamp has its clamping surfaces ground in such a way that no kinks or marks are made on the clamping surface of the tube as it is being twisted.

The inside surfaces of wave guides are sometimes plated, buffed, replated, and rebuffed to a mirror finish. Where corrosion must be considered, gold plating has also been resorted to. When taking these facts under consideration, the need for producing obstruction-free bends becomes quite evident.

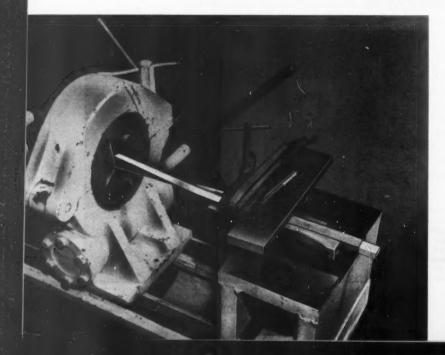


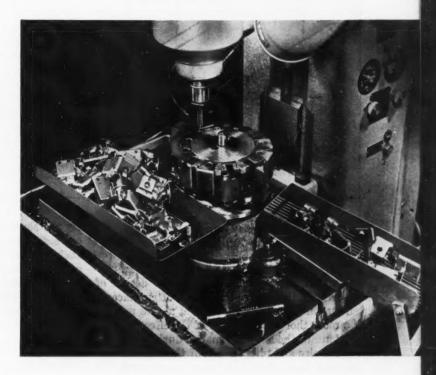
Fig. 9. Improvised torsion machine employing a worm and worm-wheel drive actuated by a spoked handwheel. The machine has just completed a 90-degree twist in a rectangular tube.

Fundamentals of Production

Tapping

Second of a two-part article describing basic information required to solve production tapping problems. Cutting lubricants, design of workpiece, and methods of tooling for production tapping are here considered

By R. H. COWAN, Vice-President Snow Mfg. Co., Bellwood, Ill.



ASIC information is required to solve production tapping problems. The fundamentals described in the first installment of this article—published in April MACHINERY—included cycle time, handling time, torque required, and style of taps. In this concluding installment, cutting lubricants, design of the work-piece, and tapping fixtures are among the subjects discussed.

Cutting Lubricants Employed for Tapping Operations

A good cutting lubricant must flow freely, dissipate heat, and carry load. Soluble oil is an excellent coolant but it is practically useless for tapping operations because it has little load-carrying ability. Sulphur-base oils are best for tapping such materials as steel, copper, and bronze, but they should be thin enough to permit free flow to the cutting edges imbedded in the work. One objection to sulphur-base oils is their tendency to discolor copper or bronze parts. Therefore, the increase in tool life obtained with such coolants must be balanced against the cost of an extra washing operation to overcome this objection. Many operators do not care to work with this black, disagreeable smelling oil.

If tapping operations are performed without a cutting lubricant, the tool life will be reduced considerably. Also, brushing of oil on the tap is an antiquated method that should be condemned. With such a method, very little of the oil will adhere to the tap after the first few threads have been cut, time is wasted in the extra motions required, and the oil rapidly becomes contaminated with fine chips picked up by the brush.

On very small blind holes, it is sometimes difficult to provide sufficient lubrication if too much oil is flooded on the work, as shown at the left in Fig. 5. A fine stream of oil can be directed into the hole in such a manner as to expel the air and fill the hole completely, as seen at the right. On the other hand, a substantial flow of lubricant may serve the additional purposes of washing chips from the fixture and assisting in ejection of the part.

It is generally a good policy to standardize on a few grades of cutting lubricants to handle normal requirements where reasonable results will be obtained. In the majority of cases, it is more economical to apply special lubricants only on those jobs that warrant the study, experimentation, and expenses involved in producing better results.

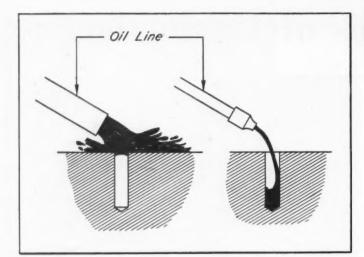


Fig. 5. If too much oil is flooded on the work, as seen at the left, the lubricant may not enter the small blind hole. This can be remedied by applying a fine stream of oil, as shown at the right.

Effect of Thread and Hole Design on Tapping

Many of the difficulties encountered in production tapping are due to improper design of the part or the tapped hole. This often places a burden on processing that would not be present if a more thorough analysis of the effect on production methods was made during design. Thread size and pitch, depth of thread, and hole size and depth should be based on strength and application requirements.

Years ago, thread specifications were established within individual factories—the manufacturer often making his own taps and setting his own standards. As the desire for interchangeability grew, however, industry-wide standards gradually came into existence and many of the old individual standards were incorporated into our present system.

Size and pitch of the thread selected can have an important bearing on cost of manufacture. For instance, a No. 10-24 thread is a comparatively troublesome size in view of the volume of material removed compared to the cross-sectional area of the tap and the small amount of flute room that can be allowed. Taps of this size are relatively weak and may break under load in tough materials.

The depth of thread should be kept as small as possible without impairing the holding qualities required, since deeper threads will increase the time required to tap the hole. Hole size and percentage of thread are extremely important from a production standpoint, and the maximum diameter hole allowable should always be used to decrease the torque requirements and increase tool life.

Normally, a lower percentage of thread can be allowed if the depth of thread is increased. By the same token, lower percentage of thread can sometimes be specified in stronger materials, such as alloy and stainless steels. The difficulty of tapping a hole having a high percentage of thread increases tremendously compared to the relatively slight increase in load-carrying ability of the tapped hole. For example, a nut having only 50 per cent of thread will generally strip the threads from the bolt before the nut itself will fail.

The amount of space provided for chips at the bottom of a blind hole should be determined by the volume of material being removed during the cutting of the thread and by the characteristics of the chip produced. Although an example might indicate that the actual volume of material removed would not exceed the volume of space allowed, it must be remembered that the chips are not packed solidly and require considerably more room to prevent the tap from bottoming and breaking. Packing of the chips in the bottom of the hole may also present a problem of chip removal that will prove costly. Insufficient chip clearance may be overcome by increasing the depth of hole, decreasing the depth of thread required, or decreasing the percentage of thread.

If conditions do not allow any of these procedures, roughing and finishing operations must be performed (with a chip removal operation between the two). The roughing tap should be special in that the pitch diameter should be sufficiently under size to remove as much material as possible without shortening the tool life or reproducing the chip problem. However, enough material must be left in the hole to allow the finishing tap to actually perform a cutting operation. This same procedure may be used in tapping materials that are too tough to complete in one pass.

Design of the Work-Piece and Fixture Influences Production

Although the actual design of the part will depend upon its ultimate use, some thought should be given to the inclusion of features that will permit economy of processing and handling. For tapping operations it is desirable to provide suitable locating points, supporting surfaces, holding points, and stripping surfaces on the work-pieces. Locating points should preferably be machined surfaces that allow proper alignment of the axis of the hole with the axis of the tap. Without such points, low tool life, tap breakage, and inability to hold the required fit may result.

The part should be supported securely on a surface that will not permit cocking or tipping during tapping. Also, a slot, hole, or hexagonal or square projection should be provided on the part to prevent the piece from rotating during tapping. This would eliminate the necessity of clamping and thereby decrease handling time. Since the tap may have a tendency to lift the part when reversing out of the hole, some flat surface should be provided for use in stripping the part from the tap.

In view of the fact that the tapping cycle is the only useful portion of the operation, and the fact that handling often consumes the greater amount of time, the proper design of the fixture is extremely important. There are two basic parts to a tapping fixture: the work-holder, which must position and hold the part during the tapping operation; and the base on which the work-holding parts are mounted.

The initial approach to any tooling problem should consist of a study of the part to determine the tooling method necessary. A sample part (even if it must be made up) often allows a "feel" that cannot be obtained from the blue-print alone. A small quantity of production parts, in the same condition that they would normally be brought to the tapping operation, would be even better, since they might show slight inaccuracies, burrs, or variations that would prevent efficient operation of the fixture.

Where the nature of the job is such that a question arises as to the workability of the selected tooling method, it is sometimes more expedient to build a rough, inexpensive model of the work-holder in order to visualize the solution. Detailed lay-out on paper at this stage may prove costly due to the expense that might be involved for revision after tooling is completed. In fact, such a detailed lay-out during any phase of the fixture development may be expensive, since this usually demands the establishment of definite specifications on every part of the tooling.

The work-holder must, of course, be accurately constructed of materials that will with-

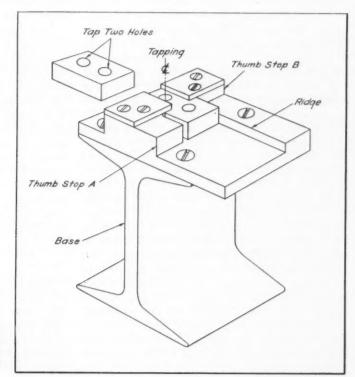


Fig. 6. Simple, inexpensive fixture made from an I-beam base on which the work-holder is mounted. Height of base facilitates loading and unloading of work-pieces and prevents chips from building up.

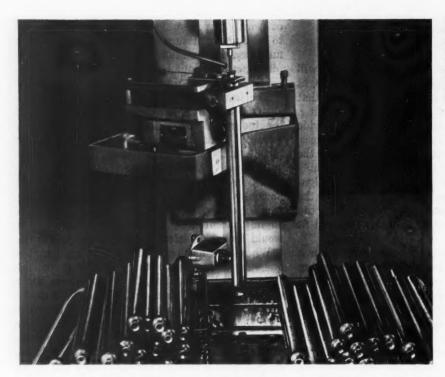


Fig. 7. Set-up employed to tap both ends of steel tubes at the rate of 600 parts (1200 tapped holes) per hour. A micro switch permits the loading of a work-piece to actuate the air clamping vise and to start the tapping cycle.

stand the wear. Much of the base, however, may not require such construction. For example, many baseplates serve no other function than to support the tooling and secure it in proper position on the work-table. In the drawing, a thickness of 1/2 inch may be specified at random. Actually, a 3/8- or 5/8-inch plate may do the job as well, but the toolmaker charged with duplicating the specified dimensions may have to order stock or machine a plate to size if 1/2 inch is not available. This procedure multiplied over many fixtures can add appreciably to the cost.

A simple, inexpensive fixture for processing a small quantity of parts, where two holes must be tapped in each part, is shown in Fig. 6. The fixture consists of a base, made from a section of standard structural I-beam, which has a clearance hole drilled through the top for chips and mounting holes for the work-holder. Holes should also be drilled through the bottom of the base in order to secure it to the table of the machine. With this type base, adequate height is provided to facilitate the loading and removal of the parts after tapping, and to prevent the build-up of chips from interfering with the operation. This base is lightweight but sturdy, and may be used with other work-holders. The work-holder shown is designed for a particular work-piece, and is milled from a block of steel and then casehardened to minimize wear. Simple thumb stops are used to position the part. A work-holding tray can be mounted on one side of the fixture to facilitate feeding.

Simplicity of the tooling is the prime requisite for efficient operation, and a minimum of effort should be demanded of the operator. It is this desire that has led to the development of more automatic methods of tooling, such as those shown in the heading illustration and Fig. 7. The degree of automaticity will depend on the expenditure warranted.

Limitations, of course, are based on the quantity and variety of parts to be processed, since large runs permit extensive study and expensive equipment. With a variety of parts, there is the possibility of developing relatively costly tooling that can be easily altered or adapted to a wide range of work, thereby amortizing initial cost over many jobs. Similarity between parts makes it possible to capitalize on basic fixture design while still combining convertibility with productivity. Interchangeable work-holders on adjustable bases can decrease tooling costs tremendously. Design features can also be incorporated into the fixture to assist in properly and rapidly positioning the part.

Federal agencies spent \$1,839,000,000 on scientific research and development in fiscal 1952, according to the National Science Foundation. The corresponding estimate for fiscal 1953 is \$2,189,000,000. The Defense Department administered about 72 per cent of the 1952 total, the Atomic Energy Commission, 14 per cent.

Factors in Choosing and Using Hydraulic Press Oils

By H. P. LAUSSUCQ Manager, Hydraulic Department Birdsboro Steel Foundry & Machine Co. Birdsboro, Pa.

T today's high-production level, hydraulic metal presses are being worked overtime, in some cases as much as twenty-four hours a day. With hard usage, they wear out faster and may be frequently down for repairs unless special attention is given to maintenance of the hydraulic oils. The selection and conditioning of a hydraulic oil, to obtain and maintain proper body and quality, are important steps toward the efficient operation of the hydraulic system, helping to assure maximum performance of the presses.

Since the oil is given hard service as a result of continuous circulation under pressure, the first requirement in its selection is proper refining to withstand these conditions; otherwise difficulties annoying and costly may develop. Most hydraulic press owners have neither the experience nor the facilities for testing hydraulic oil, and must therefore rely upon their oil supplier to furnish a suitable and dependable grade. Although suppliers are usually reliable sources of information, it seems advisable to outline the essential characteristics of a satisfactory oil for use in the hydraulic system. Physical and chemical specifications have only a limited significance in establishing quality or suitability, and for this reason cannot be taken by themselves as a reliable guide.

The Essential Characteristics of Hydraulic Oils

Chemical stability is one of the most important characteristics of the oil. It must resist oxidation and the formation of sludge or gummy deposits which are particularly harmful to the proper functioning of pumps, valves, and controls. The oil must be free of agents which would attack or harm the materials used in the construction of the hydraulic system.

Under severe conditions of service, unsuitable oils develop various acidic components, some of which corrode internal elements of hydraulic systems, including those made of certain nonferrous alloys. The amount of acidity in the oil (neutralization number) is not a dependable guide to corrosive tendencies, because some acidic components have no harmful effects whatsoever.

Therefore, freedom from corrosion can only be determined by the performance record of the oil in actual service. Hydraulic oils of superior quality will not develop corrosive tendencies for long periods even under the hardest working conditions. However, if excessive water or contaminants enter the system, corrosion may occur anyway. Oils made for hydraulic service may contain additive agents which are designed to enhance certain qualities, such as lubricity, freedom from deposits, and chemical stability.

Demulsibility—the ability to separate rapidly from water and to resist emulsification when water is present—is essential to satisfactory performance. Further, the oil should not tend to lose this quality as a result of service. The oil should have a high lubricating value to prevent metallic contact and keep wear of the pump, operating cylinder, and other rubbing surfaces at a minimum. Good lubrication is also necessary to assure smooth press action and rapid response to the action of valves and controls.

Oil of the proper viscosity is determined primarily by the pump employed. Oil too heavy for the service will produce oil drag and sluggish action of the press, whereas grades too light will result in increased wear and jerky operation. The oil should show a minimum change in viscosity with changes in temperature consistent with good service qualities. This characteristic insures continued fluidity if the press is chilled during a shut-down period, and provides adequate film protection should, for any reason, the oil temperature rise.

It is not practical to recommend types of oil for all operating conditions and to generalize for the different makes of presses. An oil suitable for one make of press might not be adequate for another. Correct viscosity for Birdsboro presses can be obtained from the Hydraulic Department of the Birdsboro Steel Foundry & Machine Co., and the same applies to other manufacturers. Their recommendations should always be followed for best results.

Oil Conditioning and Preventive Maintenance

Oil conditioning is as essential to efficient press production as oil selection. To keep a press working at top capacity, it should be regularly checked for oil level, air entrainment in the lubricating system, water in the system, oil pressure, and oil temperature.

The hydraulic system must contain an adequate amount of oil at all times. Too much oil will serve no useful purpose and may cause overflowing. Too little oil is likely to produce erratic operation and may result in a complete stoppage. The level in the suction tank of the press must be maintained at the proper height. This tank has a gage with maximum, minimum, and normal level indications. On certain applications, the suction tank is so placed as to serve also as a surge tank. In others, a separate surge tank is used at a higher level with an overflow connection between the two tanks. Both are provided with sight gages for checking the oil level, but the level in the surge tank is then automatically maintained.

The oil levels should be checked daily. If oil lines are tight and the packings are in good condition, not much oil will be consumed or will disappear, and the quantity of oil required to maintain the proper level will be small. Frequent inspection of the level requires little effort, and may often avoid minor operating difficulties. This check must always be made with the moving platen placed at full daylight opening.

Excessive foam in the oil caused by air entrainment will create a false level and can also produce irregular operation of the press. Foam may be due to any of the following causes: too little oil in the system with partial uncoverage of pump suction; leaks in suction line and packings; poor condition of the oil; addition of a large quantity of make-up, particularly if this additional oil is poured into the system rapidly; and the wrong grade of oil.

Foam exerts an oxidizing action upon the oil, and thereby contributes to the formation of deposits and a shortened service life. Furthermore, oil in its normal state is nearly incompressible, and this quality is reduced when air is entrapped. The trapped air will also cause irregular action of valves and hydraulic cylinders, and may be accompanied by chattering, noise, and, as previously mentioned, erratic press operation.

Breathers and air vents are provided in all Birdsboro presses, and in many other types of presses, to permit the ready escape of released air. Therefore, continued presence of foam should be considered abnormal and steps taken to assure its elimination.

Water may collect in the hydraulic system due to one or more of the following reasons: leakage in cooling devices; condensation on improperly installed cooling devices; condensation on interior surfaces caused by changes in atmospheric humidity, and the admission of water from external sources through improperly adjusted inspection covers.

The presence of water is generally visible at the oil level gage by a milky appearance of the oil, or sometimes by a separation line with water below and oil above the line. The man who is responsible for checking the oil level should be instructed to examine the color of the oil in the sight glass at each inspection. A change of color toward white or an unusually clear portion in the lower part of the gage usually means that water has entered the system.

The presence of water in an excessive quantity is harmful for several reasons. It may cause rust on internal parts, resulting in clogged valves, ports, and lines and rendering the press inoperative. Water reduces the lubricating value of the oil, and may be the reason for abnormal wear in the pump and other parts, and the cause of heating and the formation of deposits and sludge. It may produce emulsification of oil and water which impairs operating efficiency and may promote chemical deterioration, thus shortening the useful life of the oil.

Any mechanical or operating conditions that permit the entrance of water should be corrected without delay. The pump should be stopped for an extended interval (preferably a full week end) to give the water a chance to separate. Then the water should be drawn off through the drain cocks. If the accumulation of water is rapid, the press must be stopped and suitable repairs made at once, or costly damage may result. All oil and water must then be removed from the system in order to thoroughly clean it out. Where pipes form pockets, they must be disconnected and drained out separately. After this operation, fresh oil must be placed in the system.

The oil-pressure gage furnishes a convenient check upon the proper functioning of the hydraulic system, and should be inspected frequently. The pressure will read slightly higher than normal when the press is cold at start-up, but should drop back to normal when the oil has warmed. Pressure-regulating controls are usually provided, together with pressure relief

valves which function if the pressure becomes

The correct hydraulic pressure will vary with different installations and the type of work the press is designed to perform. This pressure is indicated on the nameplate attached to each Birdsboro press and represents the safe working pressure for which the press is designed. It should not be exceeded. The loss of pressure, if persistent, signifies defective conditions at some point in the hydraulic system and should be investigated. Common causes of pressure loss are as follows: not enough oil in system; leaks in gasket connections, in piping, or in packings; excessive foaming; higher than normal oil temperature; wrong grade or poor condition of the hydraulic oil; improper settings of relief or safety valves; defective valves or controls; and wear in the pump.

The body of the oil drops with an increase in temperature and proportionately loses its ability to prevent friction and wear. High temperatures also detract from the useful life of the oil due to the increased rate of oxidation and chemical deterioration. Consequently, the oil temperature must be prevented from rising above a safe maximum or the pump may seize and burn out. The temperature beyond which the press should not be permitted to operate depends largely upon such factors as the individual installation and the type of service.

The press is generally equipped with a thermometer, and the oil temperature should be checked at regular intervals during each shift to make certain proper cooling is taking place. Oil coolers are installed on most presses. It is especially important to check the temperature regularly if the cooler is not automatically run. On Birdsboro presses, the oil temperature is measured either in the oil reservoir immediately below the pump or directly on the pump itself. Detailed recommendations are given in manufacturers' instruction manuals for various types of presses.

Cleaning the Hydraulic System of Metal-Working Presses

Oil filters for the continuous filtration and removal of impurities from the oil is essential both to good lubrication and to the efficient operation of a hydraulic system. The presence of solid matter may cause the pump to burn out, the valves and controls to become inoperative, and closely fitted surfaces to stick or score. An oil filter is usually installed in the back pressure system of the pump or in the return from the operating valve through which the oil is continu-

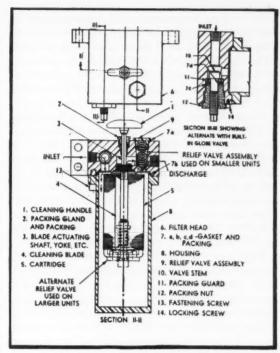


Fig. 1. Diagram of a mechanical type filter for the continuous filtration and removal of impurities from the oil in a hydraulic press

ously circulated. Instead, or in addition, a cartridge type filter can be furnished through which some of the oil in the system is continuously by-passed while the pump is operating.

A main filter is often of the mechanical (mesh) type, Fig. 1, with scraper blades that slide over the surface of the filter basket and are rotated by a handle affixed at top of the filter. It is recommended that this handle be given two turns at least once every eight hours of press operation. Since the dirt loosened by this action accumulates against the scraper blades, the filter case should be removed and the parts cleaned of sediment after the first week of press operation. Then they should be cleaned after one month of operation, and thereafter every three months or as required. A rag and clean kerosene are suggested for cleaning the filter parts.

When cleaning the blades, it is not necessary to drain the oil from the system but merely to stop the press motor and close the globe valve which is built in the filter or located in the oil line to the filter. If such a valve is not provided, it usually indicates that the filter is so mounted that an excessive flow will not occur when opened up. However, since the filter itself is filled with oil, a bucket should be placed underneath it when doing this work. Do not forget to open the globe valve after cleaning and before restarting the press motor.

The filter is usually provided with a built-in relief valve for by-passing oil delivered to it in excess of what the filter will handle-both when the oil is cold and when the filter becomes clogged. Blowing of the relief valve is generally noticeable by a slight pinging noise in the filter head. If this noise persists, it usually indicates that the filter needs cleaning.

The cartridge type filter has a very fine mesh, and is useful in removing minute particles that the other filter does not pick up. These cartridges must be replaced after the first ten days of operation and then every three months. They are inexpensive and regular replacement helps keep the oil system clean. On the latest installations a pressure gage is provided to show when the filter resistance has become excessive and requires renewal of the cartridge.

The filter element in the breather of the surge tank should also be taken out at least once every three months and thoroughly cleaned. When operating conditions are particularly dusty, cleaning should be done more often to prevent clogging. If the breather is of the wire mesh type, the element should be washed out in kerosene, and then dipped in the same oil as that used in the hydraulic system.

To clean wool-felt type breathers, special dipping solutions are on the market. No scrubbing is needed. Such cleaning compounds may not restore the original white color of the felt but will renew its filtering qualities. Kerosene may be used as an alternate, but results will be less satisfactory.

Many presses are provided with a sump tank system, Fig. 2, that has storage capacity for a separate batch of clean oil. This is a decided advantage as it avoids the necessity for shutting down the press for any length of time when it becomes desirable to purify or discard the batch of oil in use. The sump tank itself serves as a reservoir into which all the oil may be drained when doing repair work or during shut-down periods. An oil purifier with its circulating pump should be provided as part of the sump tank system to remove impurities and to condition the oil for further service. After cleaning, the oil is returned to the press by a sump pump and generally passes through an additional filter before it re-enters the hydraulic system. This filter should be checked and cleaned regularly as part of a good preventive maintenance program.

In addition to cleaning filters, it is essential to change the oil in a hydraulic system at suitable intervals. The need for renewals is based on the fact that the oil gradually suffers some loss of its original properties in service. This loss is caused by oxidation and chemical deterioration, the rate depending chiefly upon operating conditions, the quality of the oil, and the presence of contaminants.

Because of variations in operating conditions and the service qualities of different grades of oil, it is difficult to lay down a specific interval for changing oil which will hold good for every installation. Chemical analyses will provide an accurate check on changes in the oil and are recommended if facilities for this work are available. In most instances, however, the used oil samples must be referred back to the refiner for analysis and some time will be needed for this work to be completed. If there is any doubt concerning the condition of the oil, or if an excessive quantity of impurities is noted, the system should be drained immediately. Such precautionary measures will help to keep the system clean and avoid serious difficulties later on.

When facilities for checking the oil condition are not available, the oil should be changed once every six months or more often if a press is operated on an overtime basis. Measured in terms of actual operating time, 1500 hours could be considered a good safe interval. Although, in some cases, the oil will be found in good condition after this period, the protection afforded by fresh lubricant will be well worth the cost.

Cleaning the Tanks in Hydraulic Presses

When the oil is changed or drained from the system, interior surfaces of the press tanks should be cleaned by means of the inspection covers provided for this purpose. The men who go inside the tank should be cautioned to make sure that their shoes are clean or even remove their shoes. Care must be taken not to drop anything that might remain in the press and later cause injury to parts.

The tanks should be carefully wiped out with clean rags and some clean kerosene. Although it is permissible to use the kerosene to clean the bottoms of the tanks, neither kerosene nor flushing oils should be circulated through the pumps and piping system because most pumps are designed to operate on good lubricating oil only and the use of other fluids may harm them. Under no circumstances should waste be used for cleaning, since it leaves lint and may contain metallic particles which will eventually fall out. Make sure that no cleaning rags are left in the system. The safest way is to count the rags before and after.

A final precaution in keeping impurities from the hydraulic system should be exercised in the storage and handling of the hydraulic oil. Covers on containers, drums, and tanks should be kept tight when not in use. Dirt should be wiped away from the filler opening when fresh oil is introduced. Breathers should always be kept in place, and so should all caps and inspection covers that lead directly to the hydraulic system. Also, packings and gaskets should be kept in good condition to prevent contaminants from reaching the oil.

The general practice of cleanliness around a press includes regular wiping down with particular attention to the removal of dirt or abrasives from the vicinity of tension rods, guide faces, pull-back rods, main rams, and pistonrods. All rubbing surfaces should be kept free of grit to allow no opportunity for such material to penetrate internally.

Reclamation of Used Oil for Hydraulic Presses

When the hydraulic oil becomes contaminated with such quantities of impurities or water that they are not readily removed by the filters or a centrifuge in the sump system, it is often possible to reclaim the oil for further use and thereby save the cost of replacement oil. However, this condition will not always hold good, and it is important to consider beforehand the total costs involved in the light of the savings obtained. For

this purpose it is essential to know the quantity of oil to be treated at any given time, as well as the type and amount of impurities present. There are concerns which make a specialty of oil conditioning and which are technically prepared to handle the more difficult reclamation problems. In many instances, their services can be utilized to good advantage.

The subject of oil reclaiming has many aspects. A detailed discussion of all the various types and makes of filters and reclamation systems on the market would be impractical. Then, too, manufacturers are constantly improving and bringing out new designs. Therefore, best results can be obtained from current literature. However, in order to offer general guidance to the press user, the principal types of systems, individual merits, and range of usefulness are here outlined.

The settling method utilizes the normal settling action of all solids and impurities heavier than the oil in which they are dispersed. It is simple, widely employed, and usually requires the least investment. For most satisfactory results, a sufficient period of absolute quiet is required.

This method removes water and heavy dirt particles but will not eliminate colloidal material or restore original color to the oil. Moreover, it may not be found effective if the impurities

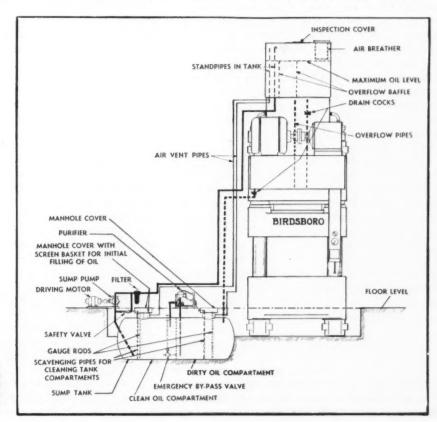


Fig. 2. Schematic diagram of the basic circuit in a hydraulic press for an oil sump system that has a storage capacity for a separate batch of clean oil

are very fine in nature. As a general rule, better separation will be secured if the settling is started with the oil in a warm condition. Therefore, the oil should preferably be drawn from the press immediately after it has been stopped, while the oil still retains its normal operating temperature.

Centrifugal separation employs a centrifuge which rotates the oil at high speeds. The difference in specific gravity between the oil and the impurities it contains is greatly magnified by the resulting centrifugal force which produces rapid separation. An important advantage of this method is that large quantities of oil can be treated very quickly. This method can be used for either continuous or intermittent purification. It is effective in eliminating dirt and water but does not remove colloids or restore original color.

Various types of filtration methods may be utilized to augment the purifying action of the filters regularly supplied with the press installation. Of the many filters on the market, details of design and capacity for purification will naturally vary quite widely. It is simplest to classify them according to type of filter element and action toward contaminants.

All filters of the mechanical class—which includes cotton waste, bag, and edge types—depend upon very small interstices in the element to limit the passage of solid impurities. The size of these interstices as well as the porosity of the element determines the fineness of the foreign materials which can be removed. The edge filter may be of the paper disc, metallic disc, or spirally wound ribbon types. None of the mechanical filters, with the possible exception of the paper disc types, will separate colloids effectively. Hence, the color of the oil will not ordinarily be restored.

The adsorptive effect of activated clay on solids and impurities, including colloidal matter, is utilized in all reclaimers of the clay type. In simple reclaimers, the clay is processed in the form of a cartridge, whereas in the more elaborate, the clay is intimately mixed with the oil and the latter passed through a filter press. As a general rule, these filters are very effective and act to restore original color to the oil, although this result will depend upon the proper condition and the quantity of clay in relation to the amount of oil being treated.

Chemical Method of Treatment

In general, the chemical method comprises a treatment of the oil with a chemical neutralization and passage through filtering media, which may be of either the mechanical or activated clay type. Properly handled, this type of filter will do an effective job and more nearly approaches re-refining. Trained supervision, however, is necessary to assure the desired quality of the reclaimed product.

Filters of the activated clay and chemical types will act to partially remove additive agents either when directly connected as a batch filter or when used on the by-pass principle. However, other filtering media are available which will not remove such additives.

A combination of any of the methods described may be employed if necessary. None of the methods will remove contaminants which are liquid in nature and which are readily soluble in the oil. Among the more common contaminants which may become intermixed are other petroleum products, animal and vegetable oils, and organic solvents. Any process seeking to remove liquid impurities will ordinarily require more equipment and chemical control than the average press operator is prepared to handle. Usually, concerns specializing in this work are the most economical and practical means of restoring the oil to usable condition.

Darkening of Hydraulic Oil

Darkening of the hydraulic oil in service or failure of the reclaimed oil to return to its original color does not necessarily imply that it is unfit for further use. For example, a very small amount of colloidal carbon may appreciably blacken the oil but yet not adversely affect its action in the hydraulic system. On the other hand, the kind and quantity of contaminants causing discoloration may be of a decidedly injurious nature. Therefore, to be certain of the true condition of the oil when the question of color arises, a complete laboratory examination is recommended.

Keeping the press hydraulic system in topnotch condition will go a long way toward minimizing "down" time for repairs and increasing production. It cannot, however, compensate for improper mechanical lubrication, incorrect adjustment, or poor mechanical condition. Preventive maintenance along those lines is another problem.

Today, man in the United States supplies less than 6 per cent of the energy used to produce his goods and food. Tools supply more than 94 per cent of the energy, having multiplied man's own productive capacity over sixteen times. From America's Muscles, National Machine Tool Builders' Association.

Ultrasonic Cleaning of Metal Parts with Ceramic Transducers

A N advanced method of metal cleaning through the use of ultrasonic waves has been announced by the Detrex Corporation, Detroit, Mich. The new method, known as the Detrex Soniclean Process, features a ceramic transducer element for directing the sound energy. By employing this element in place of the quartz crystals previously used in ultrasonic experiments, most of the limitations caused by the size and properties of quartz crystals have been overcome.

The transducer element (jointly engineered by Detrex and the Brush Electronic Co.) is a curved piece of ceramic resembling a 6-inch long pipe, cut in half along the longitudinal axis, as shown in Fig. 1. These ceramic pieces, which can be connected in series and arranged as desired, are designed to offer wide focussing and flexibility properties. Electrical energy is transmitted to the ceramic transducer, converted into sound energy, and projected through a solvent at a frequency of 430,000 cycles per second. The solvent currently being used in the Soniclean Pro-

cess is trichlorethylene; however, the process is not limited entirely to this material. Because a potential of only 40 volts is required to operate the ceramic transducers, they can be safely immersed directly in the solvent.

Material to be cleaned is placed in the solvent, either manually or by conveyor, directly in the path of greatest focal intensity of the ultrasonic waves. In this area an extreme turbulence is created, resulting in a deep and penetrating cleaning action that removes, almost instantaneously, all dirt, grease, chips, and microscopic particles of soil from even the most intricately designed and close-fitting parts, such as those seen in Fig. 2. Because of the design of the ceramic transducer, the sound waves converge to a straight line of approximately the same length as the transducer itself.

The high-frequency hypersonic generator used in the Soniclean Process is completely protected by numerous safety and overload devices. Easily adjustable tuning drawers that offer absolute frequency control are provided.

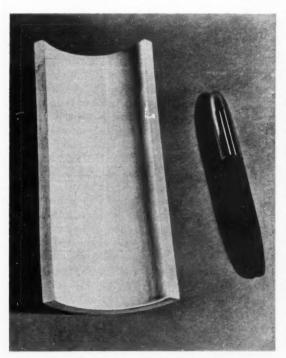


Fig. 1. Ceramic transducer element employed to direct sound energy in an advanced method of ultrasonic metal cleaning. The elements can be connected in series and arranged as desired.

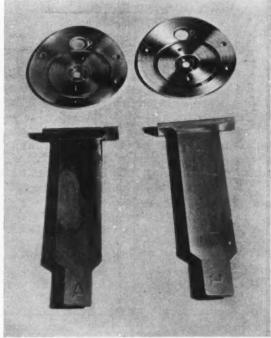


Fig. 2. Metal parts before ultrasonic cleaning (left) and after (right). Film of brass dust was removed from brass plate at top, and iron-oxide paste from the aircraft jetengine blade below.

Hopper Feeds for Bottle Caps

Concluding the series of six articles on the design of hoppers and feeding mechanisms for bottle caps

By JOSEPH and VINCENT WAITKUS

ERTAIN cap manufacturers produce a type of bottle cap about twice the size of the ordinary cap used for beer bottles. The machines producing these large caps are relatively slow-speed machines and do not require as elaborate designs of hopper feeding arrangements as for small caps. It was therefore found

advantageous to use the type of hopper illustrated in Figs. 1 and 2. This is a simplified form of hopper, the main feature being the rectifying chute, which is quite simple in itself. The rib A, Fig. 1, divides the caps so that they are all discharged with their open face up on the horizontal rotating disc B.

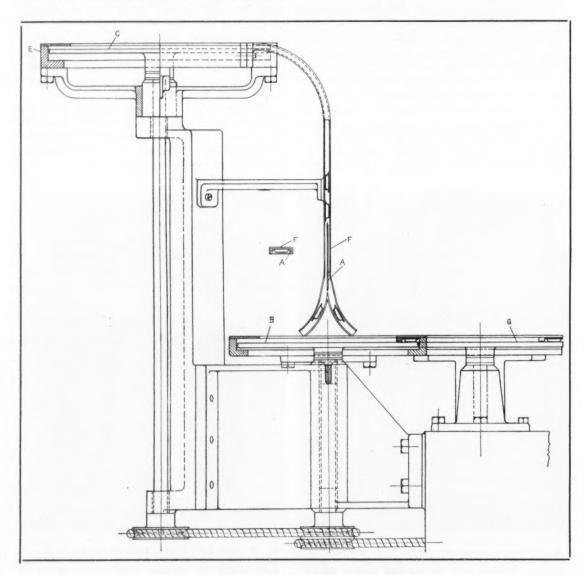


Fig. 1. Type of hopper feed used for large-size bottle caps.

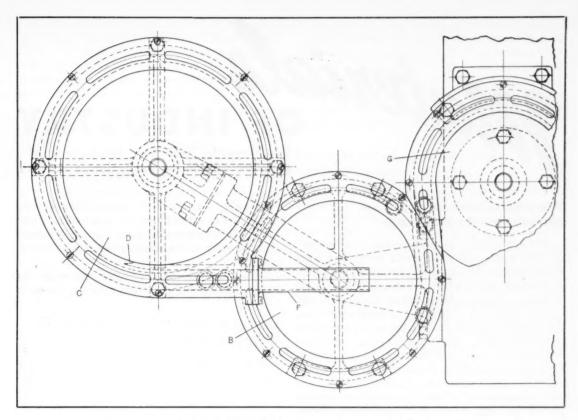


Fig. 2. Plan view of bottle cap feeding equipment shown in Fig. 1.

The charge of caps is thrown on the horizontal disc C, and centrifugal force places the caps in a single line between the bar D, Fig. 2, and the inner edge of the housing E. From this disc the caps pass down the rectifying chute F to the second horizontal disc B, where centrifugal force again is used to form a single line of caps. From disc B, the caps pass to disc G, from which they are fed into the feeding mechanism.

It is obvious that this hopper is very much simplified both in design and construction. Nevertheless, it has maintained excellent performance. However, it is restricted to a slow-speed feeding and has no means for controlling the flow of caps other than that obtained by limiting the number of caps thrown on the first disc from the bin overhead.

In concluding this series of articles, it would be well to sum up a few points relating to the application of the various types of hoppers described. It is the purpose of this description to show the development of hoppers for cap manufacturing machinery. Each type discussed has been applied to some form of bottling or bottle cap manufacturing machine. Production conditions will determine the type of hopper best adapted to meet the specific requirements of the cap manufacturer.

Fabricating Finished Parts from Steel Plate Trimmings

One of the nation's steel mills has a "cookie-cutting" service that uses the leftover trimmings from rolled steel plates. Originally such excess materials, including plate ends and side trimmings, were simply charged back into the furnace as scrap. But now the fabrication of finished parts from trimmings has become so successful that such work forms 30 per cent of the business done by the steel plant, according to Steelways, American Iron and Steel Institute publication.

Normally steel manufacturers supply customers with plates, bar stock, pipe, or other forms of steel that require finishing at the customers' plants. However, the resultant savings from producing finished parts from trimmings at the mill not only help the steel company's earnings but also cut customers' costs. For example, if a customer were to buy a square plate and cut a circle out of it himself, he would have paid freight on the leftover scrap and then pay again when it is shipped back to the mill. By ordering the circle cut at the mill, he pays freight only on the finished part. In many cases, he can have a steel shape delivered at less cost than the blank plate from which the shape would be cut.

Materials NDUSTRY

The properties and new applications of materials used in the mechanical industries

Thin-Gage Cobalt-Base Alloy Sheet Made in Wide Hardness Range

The availability of Haynes alloy No. 25 sheet in thin gages (down to 0.001 inch) has been announced by the General Plate Division, Metals & Controls Corporation, Attleboro, Mass. These thin gage sheets are produced by cold-rolling and are available in a wide range of hardness values. Hardnesses as high as 55 Rockwell C are being produced with an accompanying ultimate strength of about 322,000 pounds per square inch and an elongation of about 2 per cent. Other sheet has an ultimate strength of 192,000 pounds per square inch, a yield strength of 163,000 pounds per square inch, an elongation of 27 per cent, and a 44 Rockwell C hardness.

The spring temper, high hardness, and corrosion resistance of the thin sheet should make it useful for many industrial knife applications. Ability to withstand high temperatures has led to its use as stem pads on valves handling superheated steam at 1100 degrees F., and as deflectors in jet aircraft engines to prevent hot spots on turbine blades.

Free-Machining Screw Steels Developed for the Screw Machine Industry

A series of free-machining screw steels, available in cold-finished bar form for making screws, nuts, studs, bolts, and other small machined products, is now being produced by the open-hearth process at the Jones & Laughlin Steel Corporation, Gateway Center, Pittsburgh 30, Pa. Designated as the J & L "1200" series, the steels are comparable in chemical composition to the "1200" series steels listed by the American Iron and Steel Institute and meet the specifications of the Society of Automotive Engineers' "1100"

Three separate steel analyses comprise the series as is shown in the accompanying table.

Additional Forms of Titanium and Its Alloys being Produced

In November, 1950, MACHINERY, some physical properties of Rem-Cru titanium alloy products-RC-55, RC-70, RC-130-A, and RC-130-Bin bar, sheet, plate, forging, ingot, and billet form were given.

Rem-Cru Titanium, Inc., Midland, Pa., has now announced the availability of commercially pure titanium grades in all standard forms, including sheet, strip, plate, wire, rod, bars, tubing, forgings, and billets. Sheets are furnished annealed and pickled. Standard size sheets are 36 inches wide by 96 inches long; they are, however, produced up to 48 inches in width and 148 inches in length. Plate can be supplied up to 42 inches in width and 124 inches in length, with a limiting weight per plate of 650 pounds. Strip can be furnished in coils or cut lengths in a minimum gage of 0.016 inch.

Bars are available as hot-rolled rounds. squares, and rectangular shapes or centerless ground rounds. Simple forgings and billets are produced up to 1100 pounds per forging. Titanium welded tubing is now available in sizes 1/4 inch outside diameter and larger, in wall thicknesses up to 1/8 inch.

Designation and Composition of J & L "1200" Series Steels

	Grade Designa	tion	Chemical Composition, Per Cent					
J&L	AISI	SAE	Carbon, Maximum	Manganese	Phosphorous	Sulphur		
1211 1212 1213	C-1211 C-1212 C-1213	1111 1112 1113	0.13 0.13 0.13	0.60 to 0.90 0.70 to 1.00 0.70 to 1.00	0.07 to 0.12 0.07 to 0.12 0.07 to 0.12	0.08 to 0.15 0.16 to 0.23 0.24 to 0.33		

RC-130-A is primarily a sheet alloy, while RC-130-B is a bar and forging alloy. The sheet material, RC-130-A, is now available in standard size sheets in thicknesses of 0.025 inch and heavier, while RC-130-B is available in all standard sizes of bars, forgings and billets.

Phosphatizing Material that Produces a Complex Zinc Phosphate Coating

Oakite Products, Inc., 126 Rector St., New York 6, N. Y., has developed a phosphatizing material that produces a complex zinc phosphate coating on steel and iron to promote adhesion of paint to the metal. This material, called "Crys-Coat HC," provides a coating that is crystalline in nature and has a weight ranging from 200 to 1200 milligrams per square foot, depending on how it is applied and the type of steel being treated. It may be used in tanks and in pressure-spray washing machines.

An all stainless-steel tank set-up is not necessary, as mild steel has proved satisfactory. Only the phosphatizing material is required in applying the coating, it being claimed that no special additives or toners are needed. The salt spray resistance of painted parts treated with this material is said to be good.

Continuous Casting Process for Copper-Base Alloys

The only continuous casting process in commercial use for producing copper-base alloy stock ready for machining or other fabricating operations is being used by the American Smelting & Refining Co., Barber, N. J.

The stock is produced by having a molten alloy metal solidify in passing through a self-lubricating, water-cooled graphite die. Driving wheels, mounted directly beneath the die, withdraw the solidified rod or tube continuously at a controlled rate of speed.

Rod, tubing, and many symmetrical shapes from 7/16 inch to 5 1/8 inches up to 20 feet in length are being produced by this process. Tolerances as applied to the outside diameter of the tube are plus 0.004 inch and minus 0.006 inch. A list of some of the available copper-base alloys is given in the table below, together with their chemical compositions and physical properties.

Flux for High-Temperature Brazing and Hard Soldering

A non-spattering flux with good penetration and protection properties for high-temperature brazing and hard soldering of ferrous and nonferrous metals has been announced by the Special Chemicals Corporation, 30 Irving Place, New York 3, N. Y. "Kwikflux No. 94," as it is called, is said to eliminate island formation, prevent oxidation and scale, and protect and clean metal surfaces when brazing at high temperatures. It can be used with all standard silver, brass, bronze, and other hard solders and in all types of heating methods—direct, indirect, and induction heating.

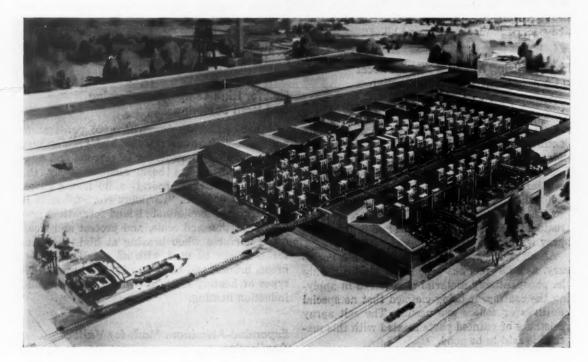
Expanded-Aluminum Mesh for Various Applications

A new form of aluminum mesh, called "Expamet Expanded Aluminum," has been made available by British Industries Corporation, 164 Duane St., New York 13, N. Y. This mesh material has many general and industrial applications, such as machinery guards, partitions, and screening. It is made in a variety of metallic and opalescent colors, in diamond-shaped and other style meshes. It can also be dyed and anodized in a wide range of colors, and thus treated will withstand corrosive attack by most acids. The anodized mesh will not peel, chip, or flake. The material is available unanodized for use in plants which have anodizing facilities.

Typical Copper-Base Asarcon Alloys

Asarcon No.	S A E No.	Nominal Chemical Composition			Typical Physical Properties				
		Copper	Tin	Lead	Zinc	Tensile Strength, Pounds per Square Inch	Yield Strength, Pounds per Square Inch	Elongation in 2 inches, Per Cent	Brinell Hardness
61	622	88	6	1.5	4.5	45,500	23,000	35	76 72 66
55	40	85	5	5	5	45,000	21,400	28	72
59	66	85	5	9	1	38,000	21,000	20	66
520		75	5	20		28,700	22,800	8	57
110	65	89	11			51,000	29,000	18	100
102	63	88	10	2		49,000	25,000	18	86
100	62	88	10		2	51,000	28,000	18	92
80	620	88	8		4	49,000	23,000	18	77
77	660	83	7	7	3	44,000	27,000	16	72
1010	64	80	10	10		41,000	26,000	10	86 92 77 72 80
210		80	2.5	10	7.5	34,000	18,000	22	62

Conveyor for Handling



SHEET-METAL trimmings are conveyed directly from the stamping presses to a baler house in the rear of the plant by means of a unique one-man controlled, underground scrap handling system recently installed at the Grand Rapids, Mich., Plant No. 1 of Fisher Body Division, General Motors Corporation. Capable of handling more than 500,000 pounds of scrap per day, this huge industrial subway is believed to be the largest of its type in the world.

Stamping plants have always had many problems in connection with the disposition of sheetmetal scrap that substantially affect both costs and production. Gripping edges, provided on the blanks to avoid wrinkling, must be trimmed from the drawn parts and disposed of. High production, large parts, and deep draws combine to make the problems of handling such material particularly acute in the automotive industry.

It has been conventional practice to stop the presses and manually load the scrap into portable bins or gondolas. These gondolas had to be trucked to the baler, and the sheet-metal trimmings had to be baled and hoisted to freight cars for shipment to the steel mill. This method was expensive because it required gondolas, power trucks, and manpower to load the gondolas and transport them out of the production area. Also, production was interrupted while clearing away

the scrap from the dies, and the gondolas in the aisles interfered with the flow of metal to the presses, as well as with the movement of dies to and from the presses. Sharp, jagged edges on the small scraps of sheet metal complicated house-keeping and added to the accident hazard.

The new automatic scrap conveyor system has greatly reduced costs and improved working conditions by eliminating the need for manual handling or gondolas, and releasing trucks and their drivers for other work. Also, production losses due to press shutdowns have been minimized, and housekeeping and safety have been improved. Furthermore, the baling operation has been simplified, and the handling of bales is now completely automatic.

As shown in the heading illustration, the automatic conveyorized system contains a series of spurs or collecting conveyor lines running under the floor along the twenty press lines. These feeder conveyors carry the scrap to a main conveyor belt that runs on the press pit floor, at right angles to the feeder conveyors, and through a tunnel to the baler house. Although this system was designed to meet the special conditions at the Grand Rapids plant, its important features are readily adaptable to any stamping plant in which presses are set in one common large pit.

As scrap is cut from the gripping edges of the

250 Tons of Scrap per Day

What is believed to be the world's largest scrap handling system has recently been installed in the Grand Rapids Fisher Body plant. The one-man controlled, underground conveyor carries sheet-metal trimmings directly from the stamping presses to a baler house, where the scrap is prepared for shipment to a mill

By CHARLES H. WICK Associate Editor



Fig. 1. Sheet-metal scraps trimmed from the edges of drawn parts fall through an opening in the floor onto the chutes seen in Fig. 2.

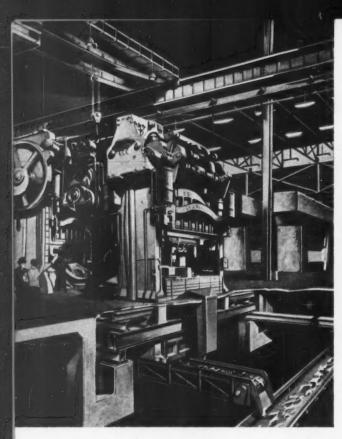
drawn parts, Fig. 1, it drops from the die into chutes, and falls onto the underground collecting conveyor, as shown in Fig. 2. For optimum efficiency with an automatic scrap handling system, the dies should be designed to cut the scrap into pieces shorter than 24 inches in length. Each of the twenty collecting conveyors catches loose scrap as it drops through the chutes from the presses on the floor above, and discharges it onto the main conveyor line—seen at the lower right in Fig. 3.

The collecting conveyors range in over-all length from 60 to 160 feet, and each has a 24-inch wide belt made from 6-inch pitch links of hinged steel belting with 3-inch high side wings on the outside links. The unique design of the hinged steel belting makes possible the handling of a wide assortment of scrap sizes. Individual belt links hinge on solid bars that run the width of the belt, and are securely fastened into the side chains so that chain and drive become an integral part of the belt. The interlocking side wings remain engaged at all times, even when the belt is passing over the end sprockets, thus preventing scrap from falling off the sides of the conveyor and jamming the belt.

Fig. 2. Underground view of one of twenty collecting conveyors. Each of four chutes carries scrap metal from an overhead press to the conveyor.



MACHINERY, May, 1953-191



Each conveyor is driven by a 5-H.P. synchronous motor, and a screw type take-up unit is provided at the tail shaft. The motors have variable-speed pulleys of 3 to 1 ratio, so that the operating speed can be varied from 15 to 45 feet per minute. Carrying capacity of the collecting conveyors is 30 pounds per lineal foot. All of these feeder lines are equipped with an automatic safety device for protection in case any line stops due to a jam. The operator must release a switch before the line goes into operation again—an important safety measure that protects the employe from injury which might occur

Fig. 3. Cut-away view showing how loose scrap is discharged from collecting conveyor onto main conveyor line shown at lower right.

if the conveyor line started immediately after the jam was cleared.

The main scrap conveyor is 1144 feet long, 4 1/2 feet wide, and varies in elevation throughout the entire length of the subway in which it moves. This conveyor is made from 9-inch pitch links of hinged steel belting with 6-inch high side wings on the outside links. Total belt length is 2308 feet. Staggered angle-iron cleats are welded to the hinge links every 9 feet, thus making it possible to push the scrap up inclines without it falling backward and piling up. The conveyor has a normal carrying capacity of 40 pounds per lineal foot. Lubrication is directed to the under side of the belt by a continuously operating oil-mist system.

Power for the main conveyor is furnished by two 10-H.P., direct-current, synchronous motors, with the load being divided between these two drive units. If a failure should occur, it would still be possible to run the conveyor with one drive unit. The motors are geared to a variable-speed drive having an 8 to 1 stepless speed range. There is no mechanical take-up required on this conveyor, because it is automatically provided at the discharge end by gravity. A maximum speed of 45 feet per minute is possible, but the conveyor is currently being operated at 20 feet per minute.

The main scrap conveyor rises approximately 15 feet in passing through the 300-foot long tunnel from the press pit level to the baler house, Fig. 4. At the discharge end of the main conveyor (in the baler house), scrap is fed by gravity into two tilting hoppers—one located on



Fig. 4. One man in the baler house controls the conveyors, baler hopper, loader, tilting hoppers, and bale chute.

Fig. 5. Loose scrap is compressed under hydraulic pressure into bales 24 inches long by 16 inches wide and of variable thickness.

each side of the conveyor. An automatic baler loader tilts from side to side, and directs the flow of scrap into one hopper or another. When a specified amount of scrap is collected, the tilting hopper dumps it into the baler pit, Fig. 5. The conveyor automatically stops moving until the hopper comes back into the receiving position.

One man, located in a glass-enclosed room above the balers, controls the main scrap conveyor, the automatic baler hopper, the loader, the tilting hoppers, a bale conveyor, a bale chute, and a car-pulling conveyor system that spots the railway car at the proper point for discharge of the bales. The two balers each have a pit 120 inches long by 60 inches wide and 42 inches deep into which the scrap is dumped. Under a hydraulic pressure of 2500 pounds, the scrap pieces are compressed into bales 24 inches long by 16 inches wide and of variable thickness—depending on the quantity and type of scrap.

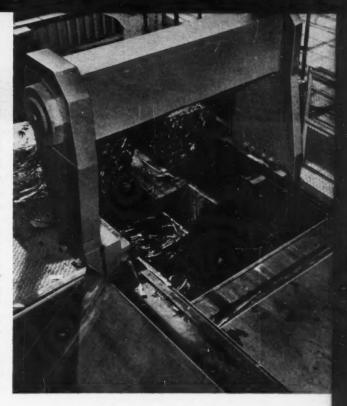
When the baler rams are retracted, the bales are raised and pushed onto another conveyor that transports them to an outside discharge chute, Fig. 6, which permits gravity discharge into railroad gondola cars. This comparatively short conveyor is 50 feet long and 4 1/2 feet wide, and is made from two 9-inch pitch side chains equipped at 6-foot intervals with fabricated, heavy pushers. The discharge chute is hinged so that it can be raised or lowered to insure even loading of the railroad car.

A car-puller conveyor positions the railroad gondola cars under the discharge chute to receive the baled scrap and insure even loading of the car. It is capable of moving six fully loaded cars with a 50-ton load at a speed of 6 feet per minute. Powered by a reversible drive unit, this conveyor will operate in either direction. The conveyor travels and returns adjacent to the railroad tracks and moves the cars by means of a spring-loaded cable that is hooked onto the railway car.

Small coins, slugs, etc., from pierced holes or slots—called "bushlings"—are too small to bale, and create a nuisance because they become entangled with the regular scrap and fall through crevices, thus causing breakdowns and poor housekeeping conditions. They must be handled separately and shipped loosely in railroad cars. At present, such bushlings fall down separate chutes from the die areas on the presses, into material-handling gondolas on the press pit floor.

Fig. 6. An outside chute permits gravity discharge of baled scrap into zallroad gondola cars for shipment to steel mill.

MACHINERY, May, 1953-193



The gondolas are then trucked to a tipple, where they are upended and dumped into a railroad gondola car.

Future planning calls for providing separate bushling conveyors that will travel alongside the main scrap conveyor or discharge directly into a railroad car. Also, the railway cars will go directly under the baler house, where the balers will discharge the regular scrap directly into them without the need of a conveyor.

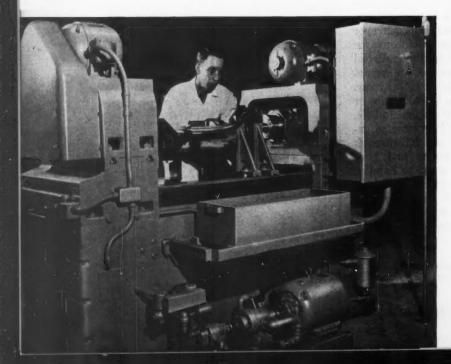




This Giddings & Lewis horizontal boring, drilling, and milling machine is shown facing the large end of a range-finder housing. Within ninety days after ground was broken for the 25,000 square-foot plant, the first range finder was delivered to the Army

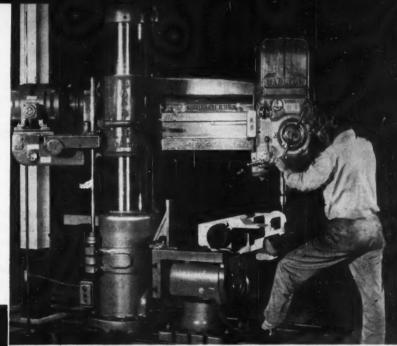
Northrop Plant Range Finders

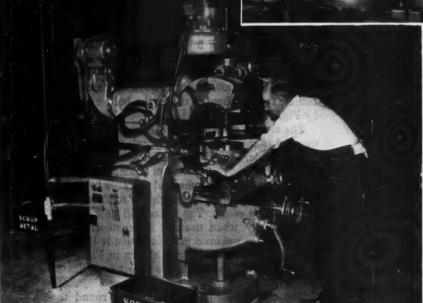
New plant of Northrop Aircraft, Inc., at Anaheim, Calif., is pioneering in the manufacture of precision optical instruments on the West Coast, with an employment potential of 2500 technicians. The plant is producing optical range finders for gunfire control of the Army's new M-47 medium tank. Typical activities are highlighted on these pages



One of a row of Ex-Cell-O machines is here shown boring the inside end diameter of one of the aluminum main housings for a range finder. Assembly of lenses and other components is performed in an air-conditioned room. Slightly pressurized atmosphere of assembly room keeps it dust-free.

Producing for Tanks



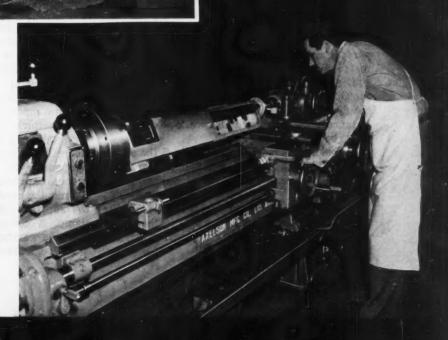


(Above) This 4-foot Carlton radial drilling machine provided with a universal table performs essential operations on a range-finder housing. Over 300 machine tools have already been installed.

(Left) Vertical movements of the end-mill of this versatile Cincinnati tool and die-sinking machine are automatically synchronized with horizontal movements of the table. Turret mounting of spindle carrier facilitates use of integral slotting attachment in boring an eye-piece holder for a range finder.

An Axelson engine lathe turns the outside diameter of the small end of a range-finder housing. The assembled instrument contains lenses, prisms, and mirrors that pinpoint targets for the tank crew.

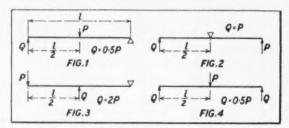
MACHINERY, May, 1953-195



Lever Type Clamps for Jigs and Fixtures

By W. H. LITTEN

In designing clamps, attention must be given to certain fundamentals to obtain satisfactory operation. To permit handling a clamp quickly, it is advisable to give it a permanent guide and to limit its forward and backward movement by locating stops. In order to lift the clamp from



Figs. 1 to 4. Diagrams illustrating application of the laws of levers to the design of clamps for jigs and fixtures

the working surface and keep it in that position when exchanging parts, a spring should be fixed under the clamp; a washer should be provided between spring and clamp to prevent the spring from creeping between bolt and clamp. Clamps that act directly on a part usually cause marks; if these are not permissible, a packing piece must be provided. If a work surface must be treated with special care, this packing piece should be of softer material than the part.

Since clamps are an embodiment of the laws of levers, it may be useful to summarize these and give simple examples. In the illustrations, Figs. 1 to 4, P= force of clamp pressing on the part; Q= reaction force of the part; $\Delta=$ clamp rest; and l $\Delta=$ acting leverage of clamp.

The example in Fig. 1 gives the smallest value for Q, but is the simplest arrangement. Force P should act as near as possible to the piece. The distance between P and the work-piece should never be greater than $1/2 \ l$.

In the arrangement shown in Fig. 2 the clamp rest should be as near as possible to the part. The distance between part and rest should never exceed $1/2\ l$.

If the scheme shown in Fig. 3 is adopted, the part should be as near as possible to the clamp rest; as before, the distance between it and the rest should never exceed $1/2\ l$.

By the system shown in Fig. 4, two parts are clamped at the same time. The force P should be chosen in accordance with the amount of force Q required to overcome the force which is exerted when machining the components. In the sketch the two forces Q are shown equal.

For general purposes, the clamps shown in Figs. 6 to 9 are recommended for clamping parts on machine tables. For finding the right cross-section in regard to tensile strength, the following simplified rules may be used: If d is the bolt diameter, as shown in Fig. 5, then the width b should equal d, and height h should be at least 1.5 d. If the clamp is used on an incline, spherical washers will insure that the nut clamps with its full surface without bending the bolt, as shown by Fig. 5.

The clamps shown in Figs. 8 and 9 are recommended if the head of the clamping screw must not protrude, or may only be allowed to protrude a little way above the clamp. Clamps shown in Figs. 10 and 11 have spherical surfaces to permit reliable clamping even though the surface of the part may be rough. The latter will hold a piece satisfactorily when used at a considerable incline, but for use on a machine table it is better to employ one of the clamps shown in Figs. 6 to 9, in conjunction with a step support as indicated in Fig. 8.

The clamp in Fig. 12 can swivel round the clamping bolt. Its movement is limited in both directions by a common stop, which speeds up the clamping process. When the position of the stop is being decided, attention must be paid to the direction in which the clamping nuts are turned while clamping. A compression spring lifts the clamp.

The clamp indicated in Fig. 13 is intended for use on components that have only a small variation in thickness. The support for the clamp serves also as a stop-pin in the clamping position. There is no stop in the position in which the components are exchanged. When designing the groove, care has to be taken that on tightening the nut the clamp cannot swivel away, and that the support center is also the center for the clamp. A compression spring lifts the clamp from the working surface.

In Fig. 14 is shown a clamp that can be with-

drawn, due to an elongated slot. The amount that it can be moved is the length of the slot minus the bolt diameter. A guiding slot is provided in the jig body to prevent dislocation and to allow quicker operation. A compensating spring is provided, as in Fig. 13.

The clamp shown in Fig. 15 is provided with an elongated hole and guided by an opening in the jig body. The extent of motion is limited by the bolt which is secured against turning.

An L-shaped clamp is illustrated in Fig. 16. The short supporting arm is guided in a groove of the jig body, and therefore secures the clamp against lateral swiveling. If the short arm is longer than 0.3 *l*, edging takes place, which seriously affects the operation of the clamp. For lifting the clamp from the part, a compression spring is used.

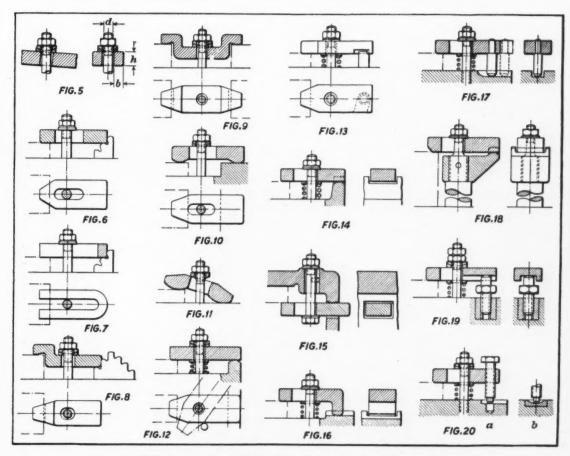
To simplify manufacture, the required shape of the clamp in Fig. 17 is produced by fitting a pin. This pin is guided in a slot of the jig body. To compensate for differences in the thickness of the work-piece, a screw can sometimes be used in place of the pin.

The clamp shown in Fig. 18 is intended to be

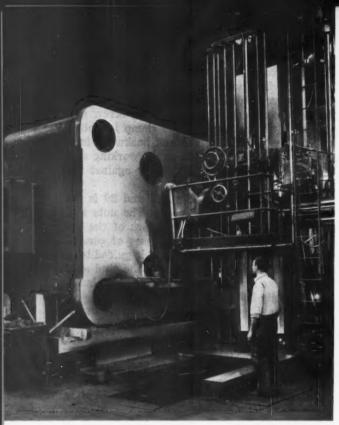
used for components which are comparatively high, and where no space on the jig body is available to serve as a rest for the clamp. The rest is therefore connected to the clamping screw and secured against swiveling. The clamp is slotted and can be moved forward and backward in a groove; it also is chamfered on the working side to enable it to be pushed securely against the work.

The hexagon stud in Figs. 19 and 20 is intended to be used for clamping. The nuts and spherical washers facilitate the use of the arrangement for different thicknesses of component. The clamp shown in Fig. 19 is guided by a groove and its motion limited by the stud slot. The clamping screw operates in a threaded bushing in the jig body.

Although the clamp shown in Fig. 20 has a stud slot, its screw is guided in a groove in the jig body. The tip of the clamping screw is hardened and presses on a hardened pin (View a). With the arrangement shown in View b, the tip of the clamping screw presses in a hollow, but it is not guided laterally. The clamping time is therefore slightly longer.



Figs. 5 to 20. Lever type clamps designed for wide range of jlg and fixture applications

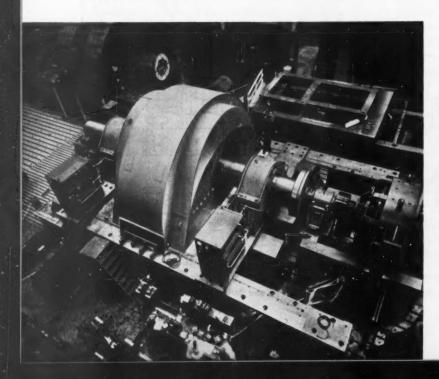


A horizontal boring mill operation is being performed on the massive top platen for a split-die forging press in the Southwark shops of the Baldwin-Lima-Hamilton Corporation. Reported to be the largest of its type in the world, the press will have an 11,000-ton capacity. It will be equipped with a piercing ram at the top and a knock-out ram at the bottom, and two horizontal side rams for clamping vertically split dies or for piercing when horizontally split dies are used. Upon installation in the Cameron

Iron Works, Inc., Houston, Tex., the press will be used for United States Army ordnance work.

In Shops Around the Country

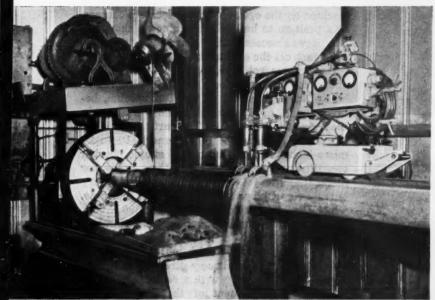
Camera highlights of some interesting operations performed in various metal-working plants throughout the nation



This 83,000-H.P. motor is one of two being completed by the Westinghouse Electric Corporation at the East Pittsburgh, Pa., plant for driving the wind tunnels of the United States Air Force's Arnold Engineering Development Center, Tullahoma, Tenn. The motor stands 21 1/2 feet high and weighs 225 tons. Both motors—the most powerful ever built—will be coupled with two 25,000-H.P. motors to create a 216,000-H.P. drive for the compressors of supersonic and transonic wind tunnels.

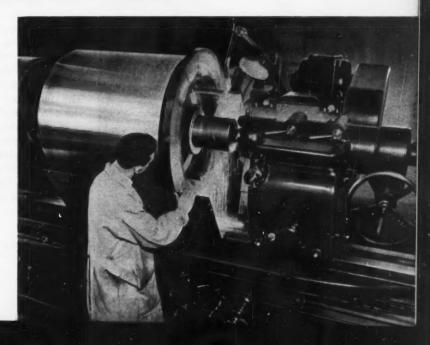
Milling the beveled surfaces of bases for desk fountain pens in the new plant of the Formica Co., Cincinnati, Ohio. The fixture accommodates two rows of bases, presenting two parts simultaneously to the slab mill. "Strata-Wood," the material used, is a wood veneer impregnated with a thermosetting resin, which is dried, cured, and then heated and compacted. Standard machine tools such as this Kearney & Trecker horizontal milling machine handle a wide variety of postforming operations.

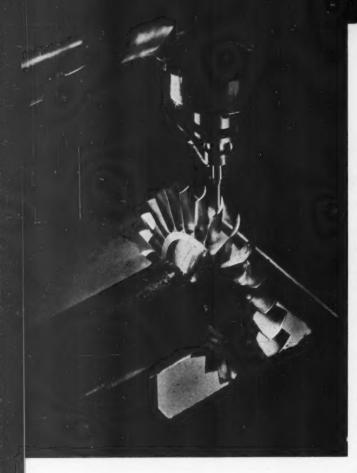


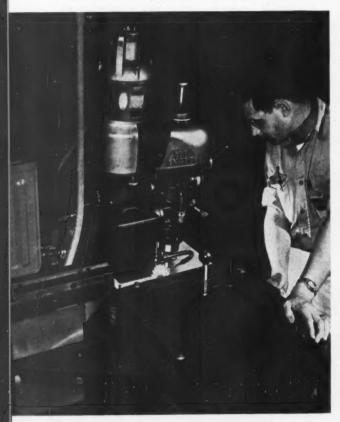


Reclaiming operation at the C & W Machine Works, of Great Bend, Kan. Two Unionmelt Type D welding heads mounted on a single carriage deposit a layer of metal on cylindrical parts of small diameter, using submerged melt welding with the multiple-bead technique. The work is chucked in a lathe, and the distance between the two electrodes is adjusted so that after each revolution the bead from the second electrode is laid down beside that from the first. A complete layer of metal is deposited on the part after three passes. The two heads halve the production time, and the spacing of the electrodes avoids overheating of the metal.

Grinding the main body and flange of a bearing sleeve made by the Morgan Construction Co., Worcester, Mass., for a large rolling mill. The illustrated operation consists of roughing and semi-finishing with a Norton "G-Bond" wheel, preparatory to mirror finishing. A new vitrifled bond used in the wheel holds the grains just long enough to accomplish their cutting job, then releases them to make room for fresh, sharp grains. A Norton 48- by 96-inch roll grinder is employed for the operation.







Milling Rotor

HE machining of rotor blades for jet engines usually imposes perplexing problems for tool designers and production men because the blades are designed with various cross-sectional thicknesses and with different angles of pitch or twist. Furthermore, the blades must be machined to extremely close tolerances and to a fine finish.

At the Marquardt Aircraft Co., Van Nuys, Calif., difficulties in the production of rotor blades for ram-jet turbines were overcome by employing a special milling machine that utilizes a Fray milling head and a work-table which are actuated in unison through a series of cams. Because it was impossible to purchase such a machine on the open market or locate a concern in a position to build the machine on short notice, it was necessary for Marquardt to design and construct the equipment.

Gas-turbine rotor blades are made of chromium-molybdenum steel, and air compressor blades are constructed of 24S-T aluminum, being brought to the special milling machine in the form of turned blanks. The parts are finished to such a high degree of accuracy (10 to 20 micro-inches r.m.s.) that only a simple burring operation is required to make them ready for installation in a jet engine. End-mills and rotary burrs are employed on the special machine, which operates at a spindle speed of 1800 R.P.M.

The heading illustration shows an operation in progress. The work-piece is rigidly held on a spindle mounted on a work-table to which motion can be imparted in any direction in a horizontal plane in unison with a combined rocking and vertical movement of the cutter-spindle. These two basic components—the work-table and the milling head—are controlled through a pair of interlocking cams. Geared to the opposite end of the work-spindle from the work-piece is an indexing mechanism which is provided for successively placing the different blades of the rotor in machining relationship with the cutter. The indexing mechanism is mounted on the work-table and moves with it.

In operation, the cutter-head is swiveled, either clockwise or counter-clockwise, in unison with the horizontal movements of the table and work so as to develop the desired curve on the rotor blades throughout their entire length. Action is imparted to the work-table by moving a

Fig. 1. Special machine constructed for cutting rotor blades of various contours for ram-jet engines

Blades for Ram-Jet Engines

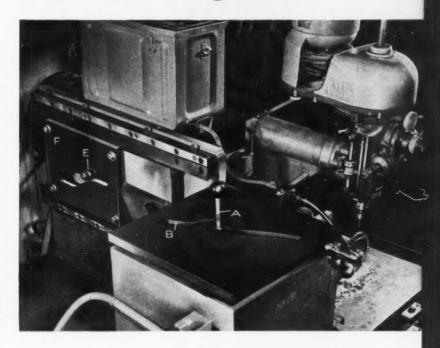


Fig. 2. Interrelated cam movements provide a slight rotation of the work in combination with a rocking and downfeed motion of the cutter as each rotor blade is machined.

ball follower on rod A, Fig. 2, along cam slot B which is cut in the top of the cam template. The lower end of rod A is contained in a ball joint located near the base of the table column, as seen in Fig. 3. Rod A is moved back and forth by turning lead-screw C, Fig. 4, through rotation of crank-handle D.

While this controlled movement is being imparted to the work-table, a related action is given to the milling head through the action of cam follower E, Fig. 4, which is moved vertically

up and down as the cam slot in sliding plate F is moved back and forth. The sliding plate is, of course, actuated through the connecting arm G and ball follower H as this ball follower moves forward, backward, and sidewise with the upper follower on rod A. Follower E is mounted on a spindle that is rigidly attached to the column which supports the milling head, and the column is pivoted so that the rocking movements can be imparted to the head (as previously mentioned) with the rise and fall of follower E.

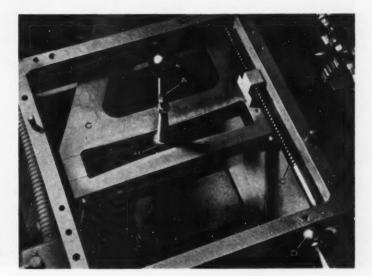


Fig. 3. View of the control column with the work-table removed so as to show the construction of the table-moving rod and the lead-screw design.

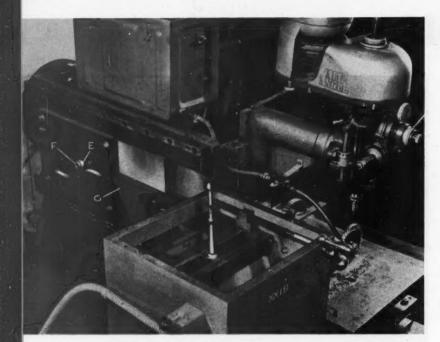


Fig. 4. Another close-up view, this one showing mechanism whereby movement is imparted from the crank-handle to the cam follower which rocks the spindle head clockwise or counter-clockwise

A counterweight insures steady operation of the milling cutter. This counterweight is attached to the end of a 1/4-inch wire rope wound around a drum type reel that is attached to the rear of the machine, as seen at the left in Fig. 2. Without a counterweight, the cutter-head would vibrate severely, causing cutter breakage and a poor surface on the rotor blades.

The ratio between the interrelated actions of the followers that operate in the cam slots is of utmost importance in machining different types and sizes of rotors. Considerable mathematical calculation is, therefore, required before the proper slot contour can be laid out for the control cams. Different cams must, of course, be supplied for the various rotors to produce the required blade forms. The cutting tools are ground to a taper to suit the individual rotors. Heim "Unibal" bearing joints and ball followers were used in constructing this machine.



Newly elected officers of the American Society of Tool Engineers as they met informally for the first time. Left to right (Front) First vice-president, Joseph P. Crosby, vice-president, Joseph P. Crosby, vice-president and sales manager, Lapointe Machine Tool Co., Hudson, Mass.; president, Roger F. Waindle, vice-president, Cannon-Muskegon Corporation, Muskegon, Mich.; second vice-president, Dr. Harry B. Osborn, Jr., technical director, Tocco Division, Ohio Crankshaft Co., Cleveland, Ohio; treasurer, Harold E. Collins, manager, process engineering department, Hughes Tool Co., Houston, Tex.; (Rear) third vice-president, Howard C. McMillen, plant manager, Philco Corporation, Bedford, Ind.; executive secretary, Harry E. Conrad; assistant secretary-treasurer, Wayne Ewing, partner, Arrowsmith Tool & Die Co., Los Angeles, Calif.; and secretary, Raymond C. W. Peterson, owner, Peterson Engineering Co., Toledo, Ohio

TOOL ENGINEERING

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Finger Clamp for Gripping Non-Parallel Surfaces

By W. M. HALLIDAY, Birkdale, Southport, England

One shortcoming of the ordinary toolmaker's finger clamp is its inability to grip non-parallel surfaces effectively. Because only one of its two jaws has a proper bearing, it is necessary to insert shims or other blocking material in the open area between the other jaw and the work. A more practical design of finger clamp for work of this nature is shown in Fig. 1. In the illustration, one side of a wedge-shaped part A bears against the upper jaw B of the clamp, and the other side bears against a block C. This block swivels on a pin D held in a slot milled into the front of the lower jaw E.

Instead of the usual two-screw arrangement of the ordinary finger clamp, this clamp has a single screw F running through the centers of

the jaws, and a pillar G aligning the back ends of the jaws. The greater part of the length of the screw is threaded and engages a tapped hole in the lower jaw. A shoulder H fits a reamed hole in the upper jaw. To prevent the screw from rising in the upper jaw when the clamp is opened, the shoulder is provided with an annular groove I, which is intersected by a pin J having a press fit in a hole through the jaw.

The back end of each jaw is formed into an enlarged square. Pillar G runs completely through a hole in the square end K of the upper jaw and has a ball-like seat (to maintain both jaws in the same vertical plane) in the square end L of the lower jaw. For the screw to function properly, it is necessary to keep the jaws parallel. This is accomplished by adjusting the position of the upper jaw on the pillar by means of a thumb-screw M which is tightened against a milled flat N.

Although primarily designed for gripping

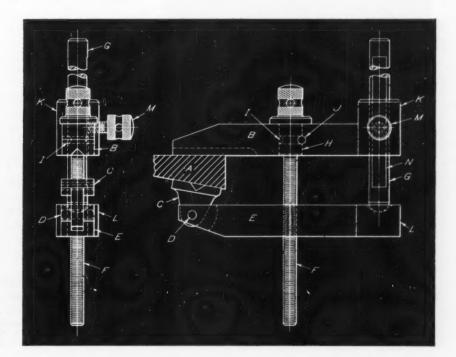


Fig. 1. A finger clamp incorporating a swivel-block provides an effective grip for non-parallel surfaces.

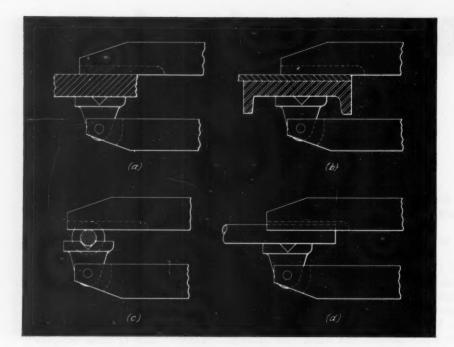


Fig. 2. Several additional practical uses of the finger clamp are shown in this

non-parallel surfaces, this finger clamp has other practical uses, some of which are illustrated in Fig. 2. The jaws are shown gripping a part having parallel surfaces in (a) and gripping a U-shaped member and a flat member in (b). Also, because the block has a crosswise vee and the

upper jaw a lengthwise vee, round stock can be held at right angles to the jaws as in (c) or parallel to the jaws as in (d).

Bench Grinder Wheel-Truing Device

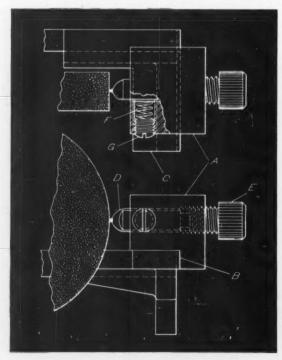
By WILLIAM C. BETZ, New Britain, Conn.

Accurate truing of a bench grinder wheel is a difficult job when performed offhand with a wheel dresser or a carborundum stick. A more precise method, shown in the illustration, is to employ a truing diamond mounted in a holding block held at right angles to the face of the wheel.

The block A has a shoulder B milled across its base. This shoulder is banked against the front edge of the tool-rest C of the grinder. Both the edge and top surface of the tool-rest are ground flat and square to each other and to the grinding wheel.

At a point in the block on the center line of the grinder, a hole is drilled and reamed to accommodate the diamond-holding rod D. This hole is tapped at its other end to receive a back-up screw E. Pressure by a spring F retained by a set-screw G bears on one side of the rod, keeping it from turning.

In use, the rod is adjusted in the block so that the diamond takes a light cut across the wheel. The shoulder of the block is kept firmly against the edge of the tool-rest while the block is traversed.



By banking the shoulder (B) against the edge of the teol-rest (C), the diamond accurately trues the periphery of the grinding wheel.

Method for Off-Center Drilling of Cylindrical Parts

By A. E. RYLANDER, Walnut Creek, Calif.

Off-center drilling through cylindrical parts in the manner illustrated in Fig. 1 is difficult enough under the most favorable conditions—such as when drilling close to the center line. The farther the hole from the center line, the greater the tendency of the drill to "walk" or be deflected down the incline so that it deviates from the intended path. The result will be a curved hole, as indicated by the broken line at A; the smaller the drill, the more pronounced the curvature. Fine drills may break, and even if they do not break, there will be inordinate wear both on the drill and in the bushing, aggravating the initial tendency to "walk."

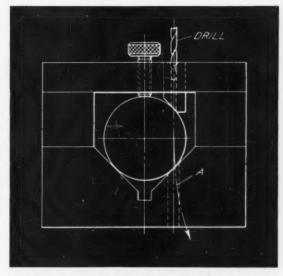
The drill can, however, be started true by the method shown in Fig. 2, which consists of first spotting a slight flat on the work-piece with a fishtail or toothed end cutter. The diameter of the cutter should be just large enough to overlap the hole to be drilled, with its radius enough larger than the hole (as shown by the inset at B) to permit starting the drill on a flat surface. If, for example, the drilled hole is 1/8 inch in diameter, then the cutter should be about 5/16 inch in diameter.

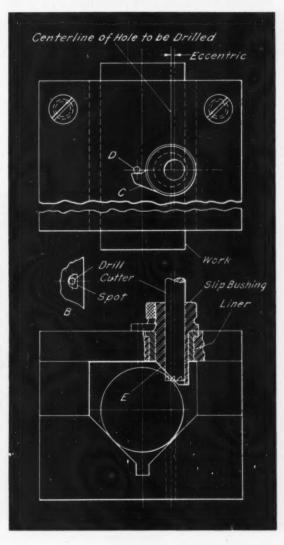
Two slip bushings are required which are interchangeable in a liner. One bushing is made concentric, for the drill. The other bushing is eccentric, the amount of eccentricity being, say, 5/32 inch for the drill-to-cutter ratio previously stated, or proportional to the drill and cutter used. Both bushings have a tail C which comes in contact with a stop-pin D, to prevent rotation of the bushing. The lower ends of the bushings are beveled to suit the contour of the work-piece for tool support, illustrated at E. As the stop acts in the direction of spindle rotation, the bushings will "stay put" during spotting and drilling. Depth of cut can be controlled by a stop-collar or by the regular drill stop.

Spotting the cylindrical piece as described provides a flat surface on which the drill can be started. Then by using a light feeding pressure it is possible to produce a straight hole in the work with even the smallest drill in the regular wire gage sizes.

Fig. 1. (Above) Simple jig for use in drilling off-center hole in cylindrical part. This jig has the disadvantage of allowing drill to be deflected from straight path.

Fig. 2. (Right) Drill jig designed to overcome difficulty experienced in drilling a straight off-center hole with jig illustrated in Fig. 1.





Semi-Automatic Stop for Blanking Dies

By FEDERICO STRASSER, Santiago, Chile

The accompanying diagram illustrates a simple yet efficient design of a semi-automatic stop for a blanking die. A surprisingly high rate of production can be obtained with the aid of this device, since it is inherently quick-acting and accurate. The upper view, a cross-section from the front of the press, shows a stop-pin A fitted in a hole in stripper B. For the stop-pin, a short piece of drill rod can be used, being long enough to extend slightly into a clearance hole C in body D when the press is in the open position.

A slot in the head of the stop-pin accommodates a spring E, which serves to keep the stop-pin down in the stripper. The stop-pin is located midway between the stock guides F and to the rear of the die cavity, as may be seen in the center and lower views from the side of the press. Distance X from the back of the die cavity to the back of the stop-pin is made equal to the pitch of the work strip. (Pitch, in this instance, is the distance measured over the bridge G, between identical points on two adjacent blank areas.)

An important element in the design of the stop-pin is the chamfer on its tip. This chamfer is in the direction of the die cavity and is at approximately a 45-degree angle from the horizontal. The length of the chamfer must be

One side of the bridge left by each blank serves as a locating surface for the following blank.

greater than the thickness of the stock that is being blanked.

In operation, the stock is inserted between the stock guides, and the first blank is cut. (The front to rear position of the stock for the first blank is gaged visually.) The stock is then advanced, and when it strikes the chamfer on the stop-pin, the stop-pin is momentarily raised, as shown in the lower view.

Advancing the stock further, until the bridge passes the clearance hole C, permits the spring E to force the stop-pin down into the area left by the first blank. Then the stock can be pulled a short distance toward the front of the press until this movement is arrested by the contact of the front side of the bridge with the rear of the stop-pin, as in the center view, and the next blank can be cut. This procedure is repeated for all subsequent blanks.

"Bouncing Putty" for Welding Steel Plate and Pipe

Silicone "bouncing putty," an intriguing chemical curiosity, has now gone to work for industry. The General Electric Co., whose Chemical Division is a major silicone producer, has found it helps to improve welds in steel plates and pipe. The famous silicone material—which can be pulled like taffy, broken with a quick snap, or bounced like a ball—is being thinned to a fluid paste and marketed as a weld-backing compound by the company's welding department at Fitchburg, Mass. The product, which is painted on joints before welding, is said to promote uniform weld penetration and to eliminate the harmful effects of air on the under side of welds.

The silicone compound is suggested for use in all arc-welding processes except automatic inertarc welding where argon is used as the shielding gas. It is easily applied to complex parts, and the powder residue left after welding can be quickly removed with a cloth. Because it promotes no carbon pick-up in the weld, it is useful in the welding of low-carbon stainless steels. The compound gives off no noxious fumes, and is non-explosive.

Fifty Years of Aircraft Production

The United States aircraft industry has produced more than 489,000 airplanes during its fifty-year history, which is an average of twenty-six planes each day since Orville and Wilbur Wright flew the first powered airplane at Kitty Hawk, N. C., in 1903.

INGENIOUS Mochanisms

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Linear Movement Reduced by Differential Chain Drive Mechanism

By L. KASPER

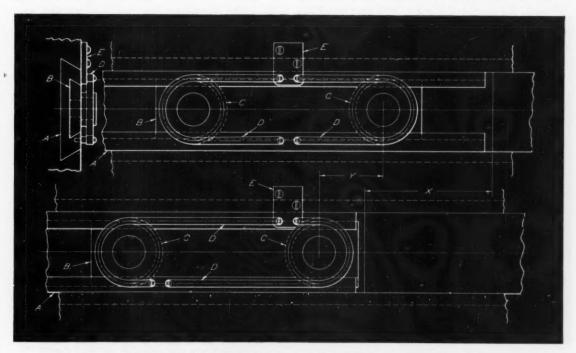
A machine producing a woven wire product was required to have two strands of wire traversed across it simultaneously at different rates of travel and over different distances but with the same time cycle. The illustration shows a mechanism designed to perform this task.

Bar A is slidably dovetail-mounted in a stationary part of the machine, and is caused to reciprocate by a cam, not shown. Bar B is slidably dovetail-mounted in bar A, and carries two sprockets C which are free to rotate on their studs. Block E is attached to a stationary part of the machine. Two chains D engage sprockets C, one end of each chain being attached to block E, the other end being attached to bar A. The guides that direct the path of the wire are not

shown. One of these guides is attached to bar A, and the other to bar B.

In the upper view, the assembly is shown at the mid-point of the traverse movement. In the lower view, the assembly is seen at its extreme left-hand position. In operation, the bar A, in moving toward the left, carries with it the two lower ends of the chains D. This movement results in an increase in the tension of the chain on the right, and a decrease in the tension of the chain on the left, so that motion is transmitted to the bar B through the right-hand sprocket C. As the left-hand sprocket C travels with bar B, it is impossible for slack to develop in the left-hand chain D.

Thus, due to the fact that the upper ends of the chains D are fixed in position and that the sprockets are movable, a differential motion is produced which results in a 50 per cent reduction in the length of the travel movement of the bar B, as indicated by the distances X and Y, in



Differential chain mechanism designed to reduce linear movement of slide

which X represents the movement of bar A, and Y represents the movement of bar B. The bar B therefore follows the same motion pattern as bar A, but to a reduced magnitude.

Positive Ratchet Mechanisms Designed for Silent Operation

By HAIM MURRO

Silent-operating positive-drive ratchet mechanisms are not too well known, and many designers are not fully aware of their advantages. By substituting a brake for the conventional spring, the pawl or finger member is lifted off the ratchet teeth on the idle stroke and made to engage the teeth again on the return stroke. Thus, although still being a positive intermittent mechanism, it works without the usual clicking noise made by the finger in riding or jumping over the teeth on the idle stroke, and therefore reduces the wear on the finger as well as on the teeth.

Referring to Fig. 1, the finger F is pivoted on an arm A which is, in turn, pivoted on the shaft S. The connecting-rod C pivots on the finger F. A spring-loaded brake B—prevented from rotating by a stud in the body of the machine—acts as a brake on a drum which is part of arm A. The toothed ratchet wheel W is keyed to the shaft S.

On the idle stroke (indicated by dotted-line arrow), the connecting-rod C will first pivot the finger F, thus lifting its point off the tooth on the ratchet wheel W. The arm A will not turn on the shaft at that time, as it is being restrained by the brake B and so offers more resistance to

movement than the finger. This finger will pivot only through a certain angle until its short finger hits the stop T on the arm. It will then force the arm A to turn on the shaft, overcoming the friction of the brake and causing the finger and the arm to pivot on the shaft as one part.

On the return stroke, the finger will first pivot to engage a new tooth, and then the whole mechanism will turn as one piece, including the ratchet wheel and the shaft.

Another design of silent ratchet, in which the connecting-rod and the finger are both pivoted on the same pin, is shown in Fig. 2. The arm A and the brake arm B are arranged on opposite sides of the ratchet wheel. A pin P fixed in the finger provides the necessary stop by engaging an elongated slot in the brake arm on one side and a circular slot in the arm A on the other side.

A design that is suitable for small-size mechanisms, and which is similar to the one illustrated in Fig. 2, is shown in Fig. 3. The brake is made of a piece of spring wire. The big disc replaces the arm, by way of example. The designs shown in Figs. 2 and 3 have the brakes operating on a drum which is one piece with the ratchet wheel, or, in other words, with the shaft. This arrangement calls for a stationary finger to prevent the shaft from reversing on the idle stroke, or else the shaft with all the elements driven by it should offer enough resistance to prevent reversal on the idle stroke in spite of the grip of the brake. Obviously, this arrangement is not absolutely necessary for the design, and the brake drum can be made part of the body of the machine, as in the design shown in Fig. 1.

A reversible silent ratchet mechanism is seen in Fig. 4. The teeth on the wheel are made

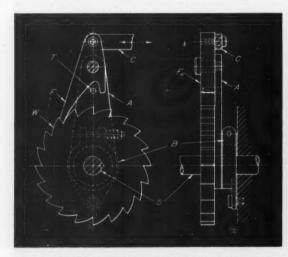


Fig. 1. Silent-operating, positive-drive mechanism with the ratchet pawl pivoted on the oscillating driving arm

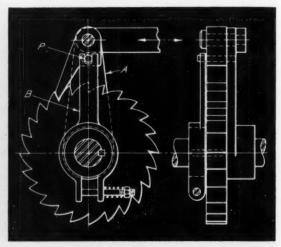


Fig. 2. Alternate design of silent, positive ratchet mechanism with connecting-rod and pawl pivoted on same pin

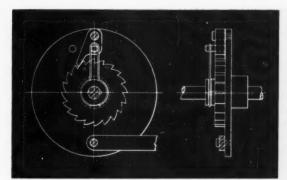


Fig. 3. (Above) Front and side views of ratchet designed for use on small-sized mechanisms

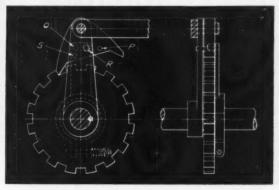
"square" to have two radial sides, for forward and reverse driving, and the finger is made double-pointed. To change the direction of drive, pin R on the brake arm should be shifted to position Q, and stop-pin P on the finger should be shifted to position S.

Both Ends of Tubing Finished Simultaneously

Double-end tube deburring and facing operations are all performed in a few seconds by one operator at the Kold-Hold Mfg. Co., Lansing, Mich. The welded steel tubes, 3/4 inch in diameter by 13 17/64 inches long and with a wall thickness of 0.028 inch, are deburred and faced on the two Pines air-operated, end-finishing machines shown in the illustration, at the rate of 600 pieces per hour.

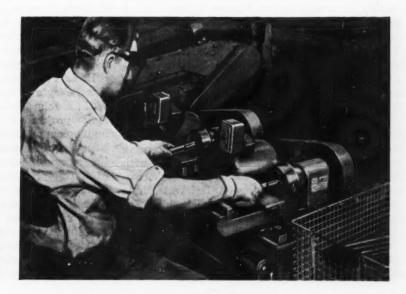
The machines are bench-mounted adjacent to

Fig. 4. (Below) Reversible ratchet with double-ended pawl



each other. One man operates both machines simultaneously by means of a single foot control which initiates the automatic clamping, feeding, and return cycles for both machines, thus freeing the operator's hands for loading and unloading purposes. The machine at the operator's left is tooled to handle an inside and outside deburring and facing operation on one end of the tubing. As soon as this operation is completed, the operator gives the work-piece a half-turn, transfers it to his right hand, and loads the twin machine. The same operation is performed on the opposite end of the work-piece, as well as facing the tube to length.

At the instant the second machine is being loaded, the operator's left hand is free to reload the first machine and maintain uninterrupted operation. Because precision tolerances on length are needed in this particular job, the second machine is equipped with an end gaging fixture. This attachment is connected to the feed rack and insures the accuracy necessary.



Two air-operated end-finishing machines are actuated simultaneously by one operator—a foot pedal initiating the automatic clamping, feeding, and return cycle for both machines.

Machine Tool Industry in

NDUSTRIAL statesmanship of the highest order is necessary today, said Swan E. Bergstrom in his opening address at the fifty-first spring meeting of the National Machine Tool Builders' Association held at the Waldorf-Astoria Hotel, New York City, April 8, 9, and 10. Mr. Bergstrom is president of the Association and vice-president of the Cincinnati Milling Machine Co. "Industrial statesmanship" consisted primarily of recognizing and assuming the responsibilities of an industry, he explained.

Mr. Bergstrom said that the place of the machine tool industry in national defense is at long last being recognized in Washington and by the general public. He urged that machine tool manufacturers cooperate completely in filling defense orders despite discouragements and difficult situations that frequently arise from Government regulations and red tape. The delivery of a large volume of machine tools still urgently needed to round out the first phase of the Defense Program was mentioned as the primary responsibility of the machine tool industry.

The Vance Plan, Mr. Bergstrom also pointed out, is still only a recommendation of a committee and would have to be considered by various branches of the Armed Forces and approved by Congress before it could be put into effect. Even if the plan should eventually be adopted, the contemplated volume of machine tool purchases would only be a fraction of the industry's capacity, and purchases would not be evenly distributed throughout the industry.

Mr. Bergstrom stated that the market upon which machine tool builders should concentrate today is a replacement market in the field of civilian goods manufacture. He stressed the point that productivity, not production, has given our country the highest standard of living in the world and that high productivity is obtained only when there is a broad market for some product. Machine tools are the basis of all productivity.

Tell Berna, general manager of the Association, reported for various standards committees and then stressed the importance of the coming sales conference to be held in cooperation with the American Machine Tool Distributors' Association at Purdue University, Lafayette, Ind., July 20 to 25, inclusive. Mr. Berna pointed out that 760 sales managers, vice-presidents in charge of sales, district managers, and sales engineers have attended these conferences since the first one was held in 1948.

In his paper "Let's Tell the World," Joseph T.

Vinbury, chairman of the Advertising Committee and advertising manager of the New Britain Machine Co., described the procedure followed in selecting the winners of advertising awards made for the first time by the Association. Over 200 advertisements were entered in the contest. Following Mr. Vinbury's address, the awards were presented by Mr. Bergstrom.

Mr. Vinbury also discussed the importance of advertising and sales promotion to any selling program, and pointed out that because of the tremendous number of metal-working plants in the country today, it is impossible for any concern to have enough trained sales engineers to personally visit all of the people to whom machine tools have been sold. Technical magazine advertisements, catalogues, instruction books, parts lists, specification sheets, etc., are the answer. He also reported a distribution of more than 600,000 copies of "America's Muscles," a booklet describing machine tools which was developed under the auspices of the Advertising and Public Relations Committees.

"The Growth of Understanding" was the title of a paper presented by William L. Dolle, chairman of the Public Relations Committee and president of the Lodge & Shipley Co.

Activities of the Subcommittee on Tax Policy

Donald M. Pattison, former Director of the Metal-Working Equipment Division, National Production Authority, and vice-president of sales of the Warner & Swasey Co., spoke on the subject of interim controls. Milburn A. Hollengreen, president of the Landis Tool Co. and chairman of the Government Relations Committee, gave an outline of the reports later made by the several subcommittees.

K. L. Finkenstaedt of the Subcommittee on Tax Policy and executive vice-president of the W. F. & John Barnes Co., stated that one of the major projects of his Subcommittee and Washington counsel during the last few months had been the preparation of a memorandum on taxation recommendations for submission to the staff of the Joint Committee on Internal Revenue Taxation. These recommendations have been submitted with a memorandum explaining that they were designed not only to assist the machine tool industry in remaining strong but also to improve the industrial economy of the Nation without endangering revenue necessary to meet the continuing Defense Mobilization Program.

Transition — Theme at Meeting

Five major proposals were included in the recommendation. The first suggested a change in Section 433 of the Internal Revenue Act with regard to the imposition of the excess profits tax. The second proposal related to the accelerated amortization provision of the Revenue Act of 1950, which permits the issuance of certificates of necessity on emergency facilities. It was recommended that Section 124A be amended retroactively on machine tool expansions so that 100 per cent certification may be granted for all facilities, any part of which has heretofore been certified.

A further recommendation proposed an amendment whereby the President of the United States could determine whether an industry had completed its emergency production schedule, and, if so, permit the taxpayer to recompute his amortization over the period ending with the presidential proclamation.

A third proposal urged the amendment of Section 23(1) of the Internal Revenue Code by permitting a system of optional depreciation applicable to "durable productive equipment" acquired after December 31, 1952. Under this system, machine tool builders and their customers acquiring machine tools would be permitted, at their election (perhaps with some limitations to protect the revenues), to write off all or part of the cost of new equipment in the year it was acquired and placed in operation. A balance of the cost would be written off over subsequent years in a manner designated by the taxpayer.

The fourth proposal recommended the elimination of double taxation on corporate earnings as soon as revenue requirements would permit. The fifth proposal recommended amendments to clarify and make more administratively feasible Section 102 regarding the surtax placed on Corporations with improperly accumulated surpluses. Another proposal informally discussed related to liberalizing allowable deductions for research and development expenditures.

Mr. Finkenstaedt also referred to conversations held with new Treasury officials and reported their opinions regarding the possibility of more liberal depreciation allowances on capital equipment.

Subcommittee Procurement Policies

A paper prepared by Herbert L. Tigges, chairman of the Subcommittee on Procurement Policy and executive vice-president of Baker Brothers, Inc., was delivered in his absence by R. W. Ban-

field, vice-president of the Pratt & Whitney Division Niles-Bement-Pond Co. Mr. Tigges advised that his Subcommittee is endeavoring to have the various service and buying agencies in Washington adopt terms and conditions which apply to productive equipment only. The Subcommittee has made a careful study of procurement policies of the various government buying agencies to determine those which apply to machine tools and those which are acceptable or unacceptable to the machine tool industry. A fifty-seven-page report will be submitted to top level men in Washington.

The Subcommittee has viewed with concern the product liability or safe and harmless clause in Government contracts. This clause transfers to the machine tool builders, or attempts to do so, the responsibility for a contingent liability, that is, damage which might be caused by the operation of a machine tool. There is also a question of liability in connection with machine-tool servicemen and sales engineers in customers' plants, as well as inspectors from customers or other visitors to machine tool plants. The Subcommittee suggests that such clauses should not be accepted without their consequences having been considered and adequate insurance arranged.

Machine Tool Renegotiation Policy

Sales of machine tools to the Government for national defense should be subject to the same renegotiation procedure as sales of machine tools to private industry for defense production, according to A. G. Bryant, vice-president of the Cleereman Machine Tool Co., and chairman of the Subcommittee on Renegotiation. "Under the existing law," Mr. Bryant pointed out, "sales to private industry are subject to only partial renegotiation in recognition of the fact that the machines will continue to be used for peacetime production after the defense emergency is over. On the other hand, sales of machine tools for Government account are subject to renegotiation on the entire purchase price, even though they, too, with very few exceptions, are types of machines that can be used for civilian production after defense contracts have been fulfilled.

"One hundred per cent renegotiation of sales for Government accounts is completely unrealistic. They should be entitled to the same partial exemption from renegotiation as sales to private industry.

"After World War II, the competition of government-owned machine tools sold as surplus at sacrifice prices forced the machine tool industry to a level of operations that was dangerously low from the standpoint of national defense, resulting in a frantic call for expansion at an impossible rate when Korea happened. A repetition of this same situation is threatened today."

Other Important Papers Presented

Overseas markets and foreign machine tool sales in the United States were discussed in a paper presented by Ralph J. Kraut, chairman of the Subcommittee on Overseas Markets and president and general manager, the Giddings & Lewis Machine Tool Co. Mr. Kraut referred to the greatly increased competition of foreign machines on the domestic market and the loss of representatives of American machine tool builders in foreign cities due to the restrictions against shipping abroad American machine tools from the beginning of the Korean episode. Mr. Kraut expressed the opinion that aggressive selling methods would regain foreign markets, and at the same time expressed disappointment that few machine tool builders were planning to

exhibit at either the Canadian Toronto Fair to be held in June or at the European Brussels Fair to be held in September.

Ralph S. Howe, chairman of the Subcommittee on Permanent Defense Capacity and executive vice-president of the New Britain Machine Co., described in considerable detail the objectives of the Vance plan, explained how the plan would work out in practice, and discussed the savings to the taxpayer. He warned, however, that if the Vance proposal were partially initiated, the machine tool industry could expect not much over \$500,000,000 to \$600,000,000 worth of new business in the next year or two, and that this was hardly half the current rate of operation.

Everett M. Hicks, chairman of the Machine Tool Show Committee and vice-president of the Norton Co., discussed plans for the machine tool show being contemplated for 1955. An inspiring address—"The American Heritage, A Continuing Force"—was delivered at the dinner meeting by Dr. John Allen Krout, vice-president and provost of Columbia University.

Machine Tool Distributors Hold Meeting in Cincinnati

THE twenty-ninth spring meeting of the American Machine Tool Distributors' Association was held at the Netherland-Plaza Hotel, Cincinnati, Ohio, Thursday and Friday, April 16 and 17. The session was opened by the president of the Association, John M. Riordan, president of the Riordan Machinery Co., and was followed by an address delivered by Tell Berna, general manager of the National Machine Tool Builders' Association. Mr. Berna emphasized that a highly competitive era lies before the machine tool industry, and advised that now is the time to prepare for this tougher period of selling. The average backlog for the industry, he said, is equal to about nine months' production.

Then H. Rourke, general purchasing agent of the Ford Motor Co., presented a paper entitled "What the Large Machine Tool User Expects from the Machine Tool Industry in the Next Five Years." Mr. Rourke stressed the importance of three points in machine tool selling: (1) providing dependable engineering service during the planning stage of a new installation, during the early production period, and when repair parts are necessary; (2) positive delivery of machines and tools as promised; and (3) high quality of materials and workmanship. Automation is becoming increasingly important, according to Mr. Rourke, since the potential capacity of a machine is often limited by the rate at which it can be humanly operated. Although automotive engineers have done some work on automation devices, they are looking to machine tool builders for the application of this type of mechanism to their equipment.

Charles F. Kettering, research director of the General Motors Corporation, spoke on the subject of machine tools at the Thursday luncheon. He advised machine tool distributors to be careful concerning the danger of becoming too specialized in their thinking. Speaking about future accomplishments, Mr. Kettering said that progress requires looking ahead but that engineers should not make the mistake of looking ahead in terms of today.

At the Friday session, addresses were given by Donald M. Pattison, former Director of the Metal-Working Equipment Division of the National Production Authority and vice-president in charge of sales of the Warner & Swasey Co.; Thomas R. Rudel, chairman of the Subcommittee on Renegotiation and president of the Rudel Machinery Co., Inc.; and Joel Barlow of Covington & Burling.

Questions and Answers

A service to readers who have questions pertaining to the metal-working and machine-building industries

Breach of Machine Tool Guarantee

F.B.C.—What is the law in event that a seller breaches a contract or guarantee that a machine tool will perform certain work or produce specified results?

Answered by Leo T. Parker, Attorney at Law Cincinnati, Ohio

If a seller breaches a guarantee, the buyer may, at his election: (a) Keep the machine and plead breach, receiving compensation by a reduction in or cancellation of the contract price; (b) keep the machine and file suit against the seller for damages; (c) refuse to accept the machine, if the legal title has not passed, and file suit against the seller for damages; (d) rescind the sale contract and refuse to receive the goods; or (e) return the machine, or offer to return it, and sue for the price or any part thereof which has been paid.

W. H. Bint Co. vs. Mueggler [154 Pac. (2d) 513] showed that a purchaser accepted a machine and took legal title thereto. Later he discovered that the seller had breached his warranty. The court held that, since the legal title had passed to the buyer, he could sue and recover from the seller the full damages sustained because of the seller's breach.

Using Titanium for Castings

T.A.H.—What is the picture with respect to employing titanium for castings in lieu of stainless steel or nickel?

Answered by the Valve Clinic of The Cooper Alloy Foundry Co., Hillside, N. J.

Titanium metal, besides being very difficult to cast, is not too resistant to sulphuric and hydrochloric acid, having about the same resistance as AISI Type 316 steel. Its resistance is the same as AISI Type 304 steel in boiling 65 per cent nitric acid. It is, however, very resistant to aqua regia, oxidizing acid chlorides and wet chlorine, against which all of the stainless steel alloys have very poor resistance. Titanium alloys, when fully developed, will undoubtedly play a big role in corrosion resistance in the future.

Truing and Dressing Grinding Wheels

A.G.L.—Is there any difference in the meaning of the words "truing" and "dressing" as they are applied to grinding wheels?

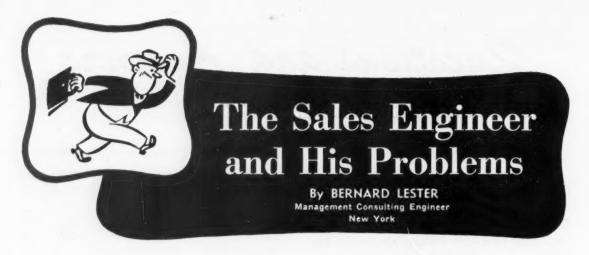
Ans.—Although the terms "truing" and "dressing" are often used interchangeably and although there is some overlapping of the two operations, each is performed with a different purpose in mind, according to definitions recently given by the Norton Co., Worcester, Mass.

A grinding wheel is "trued" in order to restore its cutting face to running truth, so that it will produce perfectly round (or flat) and smooth work, or to alter the cutting face for grinding special contours. On the other hand, a grinding wheel is "dressed" in order to improve or to alter its cutting action. The dressing tool removes the outside layer of dulled abrasive grains and any loading of metal or foreign material that the wheel may have picked up, so that new and sharp abrasive grains are presented to the work. In this respect, dressing sharpens a wheel but does not necessarily true it.

Serious Shortage of Engineers

Shortage of experienced engineers has become one of the aircraft industry's most serious manpower problems, according to an article in a recent issue of *Planes*, official publication of the Aircraft Industries Association. To fill this growing need of the aircraft industry, as well as that of the rest of American industry, it has been estimated that a minimum of 30,000 engineers should be graduated from United States schools each year. The expected graduation this year will be about 10,000 below that minimum.

These shortages are magnified as it becomes necessary to build the heavier and more complex airplanes required in an atomic and supersonic era. A typical modern fighter, for example, requires twenty-seven times as many engineering hours as its World War II counterpart. Among the extensive programs of the aircraft industry to meet production requirements despite the critical shortage of engineers are (1) intensive recruiting, (2) job simplification projects, (3) training activities, and (4) subcontracting of work ordinarily done in home plants.



Our Attitude Toward Competition

NUSUAL military demands can easily inflate our sales ego and deflate the significance of competition. Many a hard-working young sales engineer hasn't yet had a chance to buck real competition. Lots of older men have lost the feel of it.

Selling without some form of competition isn't selling at all. To move and accelerate, we need friction, besides ample power. Both obstacle and opportunity create the atmosphere for success in business.

Competition is much broader than confronting a specific machine, a price, or delivery date. It may be meeting a different process for getting results. It may be a contest for the purchaser's dollar, otherwise to be allocated for a different purpose. But above all, competition is determined by the resources and activities of the other suppliers.

Recently in establishing a course of sales training for a machinery manufacturer, the president of the company told us: "You needn't consider competition. I want my sales engineers to think and talk only about our own products and service."

In opposing this injunction, while admitting the wisdom of not talking about competition, we related the following personal experience to support the absolute need of studying competition:

"Years ago when buying an automobile we decided to choose between two popular makes, identified here as Car A and Car B. The year before, A had given notorious rear-axle trouble. Many differentials had to be replaced.

"The salesman for A had explained to us how a redesign had fully corrected this difficulty (though he didn't drive home to us the advantage of doing business with a company that makes good on any defects in its product). "We eagerly anticipated how the B salesman would capitalize his competitor's weakness. Expound on A's trouble? No, he never mentioned it. But in featuring the construction of his car, he started with the rear axle and differential. 'We're particularly proud of this construction,' he exclaimed. 'It's been unchanged because it's given such outstanding satisfaction.' This feature, then, was the springboard for other selling arguments that persuaded us to buy Car B."

This incident illustrates that we must know competition and know it well, for competition gives form and shape to our aggressive selling procedure. Our attitude toward competition must be very real, for by recognizing its traits, we can shape the mold of our selling arguments to make them most effective.

In knowing competition we must readily recognize its five principal forms:

1. The competitive machine—its features of construction and performance.

2. The competitive potential supplier—his facilities and record of performance.

3. The proposed competitive process, which may differ from our own, yet is intended to achieve the same result.

4. The competition for the prospect's dollar, wherein he debates investing in equipment we offer, in preference to some quite different expenditure.

5. The strong and weak points of the opposing salesman.

If we are to sell successfully and efficiently, our attitude toward competition must therefore be inclusive. We must quickly sense all elements in competition that confront us. Unless we do this, our selling arguments are misplaced and our selling effort often ineffective.

Just recently upon inquiring about competi-

tion, two different salesmen made these two contrary replies:

"I ignore it when talking to a prospect. I'm interested in my prospect, his problem, and getting him to recognize that I can provide the answer."

"Competitors just wear the life out of me. Seems like so much time is taken up trying to prove the other fellow's machine or recommendations don't fully meet the problem."

We may well say that the first salesman was reveling in friction that made the tires grip, while the second, unable to recognize the value of resistance, was content to let the wheels slip.

Every advantage stated by a competitive salesman can be met by an opposing idea to establish an opinion advantageous to our side. Let's cite just a few instances:

The competitor's price is lower. "We can't quarrel with that, because our competitor knows better than anyone what his product is worth."

The competitor's delivery is shorter. "Yes, we could shorten our delivery at the cost of extreme care, endless tests, and inspections required by our standards of manufacture."

The competitor has been in business twice as long as you. "Very true, but don't we find the younger company often less lethargic, and more alert and active in introducing new ideas?"

Today, the best run suppliers welcome clean, aggressive competition. Likewise, the victorious salesman recognizes that without competition selling would be a meaningless and unrewarding affair. To be successful salesmen, we must consider the various ingredients of competition and adopt a constructive attitude toward them.

Norton Consolidates Grinding Machine Division in New Plant

THE Norton Co. recently started operations at a new plant in Worcester, Mass., which will house the Grinding Machine Division. The \$6,000,000 project provides increased capacity and consolidates under one roof production of the company's complete line of forty-five different types of precision grinding and lapping machines. A feature of the 275,000-square foot single-story factory area is three production lines, each one having all necessary machine tools for fabricating a particular class of work. Special materials-handling equipment, air-recirculating dust control equipment, forced ventila-

tion (providing three complete air changes per hour), and a new semi-direct industrial lighting system have also been installed.

A growing backlog of orders made this expansion of manufacturing necessary. Most of the other buildings occupied by the Division date back to pre-World War I days, some even to 1900, when Norton originally developed its plain cylindrical grinding machines. The new plant has increased the company's manufacturing capacity by about 50 per cent, and as a result of more efficient methods it is expected that delivery dates can be substantially shortened.



View of one of the five manufacturing bays of the new Norton Grinding Machine Division plant



Cleveland Rotary Planer Designed for Rapid Milling of Structural Members

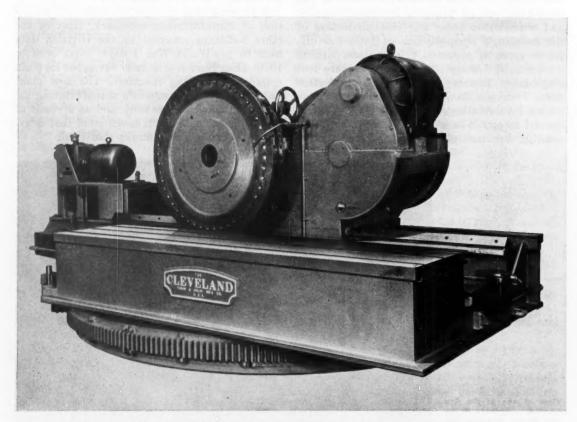
The Cleveland Punch & Shear Works Co., Cleveland 14, Ohio, has built a rotary planer which is designed for use in milling structural members and castings. This machine is said to be especially adapted for machining operations on ingot molds and similar types of heavy work.

The planer can be furnished with cutter-heads of various diameters to suit specific requirements. The 48-inch cutter-head on

the machine shown in the accompanying illustration has an in-andout adjustment range of 4 inches, which is obtained by means of handwheels arranged to facilitate operation from either side of the carriage.

A feature of this rotary, planer type machine is the electrically controlled hydraulic feed developed for traversing the cutterhead. The planing length capacity is 7 feet 6 inches, the feeding range from 1 inch to 10 1/2 inches per minute, and the operating speed of the cutter-head 50 feet per minute.

Although the planer shown is mounted on a circular base and is rotated by means of a ratchet wrench, this type of machine can also be furnished without the circular base feature and with bed and table lengths to suit the customer's particular machining requirements.



Rotary planer built by the Cleveland Punch & Shear Works Co. for milling structural members and castings

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

Gear-Shaving Machines for Finishing Large Gears

Large gears with diameters up to 15 feet and face widths up to 48 inches can be finished rapidly, accurately, and at comparatively low cost by four models of vertical gear-shaving machines announced by the Michigan Tool Co., 7171 E. McNichols Road, Detroit 12, Mich. The machines in this V-series can be used for finishing internal or external spur, helical, or herringbone gears made either with or without integral shafts. This in-

cludes a wide range of gears used in marine, railroad, power plant, ordnance, and other large-gear applications.

The machines are said to effect a drastic reduction in, if not the elimination of, time-consuming lapping operations. Also, they reduce finishing time and produce large gears of exceptional accuracy. They are provided with facilities for mounting integral gear-checking accessories, making

it possible to check gears before their removal from the finishing machine. Other features include provision for accurately controlling the true involute tooth forms, especially at the pitch line; incorporating and controlling tip relief in the tooth form of the gear (to avoid chance of interference as the mating gears roll into mesh); and finally, giving the gear tooth surface a finish that is as fine as 12 micro-inches r.m.s.

Largest of the four gear-shaving machines, the Michigan V-180 shown in Fig. 1, will accommodate

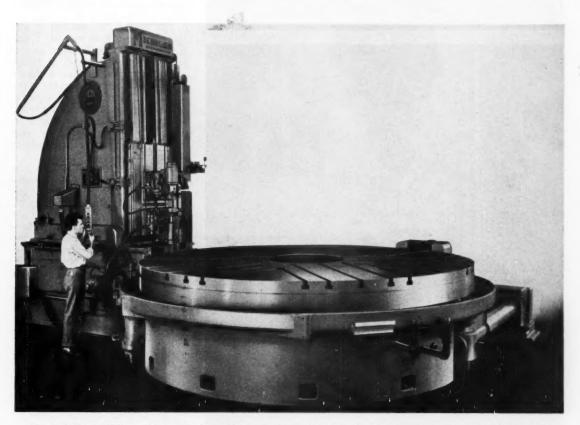


Fig. 1. Michigan V-180 gear-shaving machine with capacity for finishing internal and external gears up to 15 feet in diameter



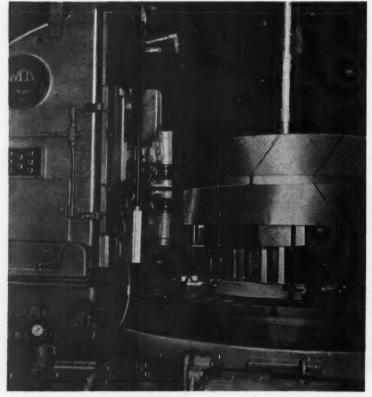


Fig. 2. Michigan V-48 gear-shaving machine set up for finishing internal gears 48 inches in diameter with a face width of 30 inches

internal or external gears from 100 to 180 inches in diameter. The table is provided with a hole 36 inches in diameter to permit handling gears with integral shafts. The machine has a capacity for shaving spur, helical, and herringbone gears 65 inches wide. It requires a floor space 208 by 210 inches and has a height of 166 inches.

The V-120 gear shaver will handle internal or external gears from 60 to 120 inches in diameter, and has a 30-inch diameter hole to accommodate gear shafts. The maximum gear width capacity for spur, helical, and herringbone gears is 50 inches. The machine is 207 inches long, 147 inches wide, has a height of 148 inches, and weighs 76,030 pounds.

The third machine in this line, the V-72, has a capacity for shaving gears from 20 to 72 inches in diameter. It will shave internal or external gears 50 inches in width. A table hole 18 inches in diameter accommodates gears with integral shafts up to this size.

The V-48 is the smallest of the line, having a gear capacity from 8 to 48 inches in diameter and a table hole 12 1/2 inches in diameter. This machine has a maximum gear width capacity for spur, helical, and herringbone gears of 30 inches. Base dimensions are 94 by 124 inches and the height is 126 inches. Magnetic chip conveyors are optional equipment on all models.

All models except the V-48 are available with dual cutting heads. The two cutting heads are independently adjustable for correct angle, and the top head can be adjusted for height. The use of two cutters materially decreases cutting time. With a herringbone gear, each cutter shaves one helix face, so that both helices may be cut simultaneously.

Large gears are shaved by means of cutters shaped similar to gears but with the teeth serrated to provide a series of cutting edges. The rotary cutter and gear rotate in mesh, the latter acting as

Fig. 3. Close-up view of V-72 machine sot up for shaving large herringbone gears, using two "guided" cutters on dual heads

the driver. The axes on which the gear and cutter are mounted are not parallel. With this crossing of gear axis and cutter axis, each cutting edge sweeps in a shearing action across some part of the gear tooth face as the gear revolves.

In addition to the dual cutterheads, each cutter is available in a new form—actually two cutters in one. Although of one-piece construction, this cutter has a wide groove in its center section which gives the effect of two separate cutters, for shaving two sections or zones on the gear. Each shaving zone serves to guide and steady the cutter in the other shaving cutter is slowly reciprocated up and down across the face of the work.

A checking device has been designed so that a gear can be checked for run-out on both the shaft and rim, and for axial pitch while on the work-table. The device is mounted independently on the vertical slide. Vertical gageblocks are used in conjunction with the micrometer when checking axial pitch.

The tables on the three larger machines are supported by an oil film whose pressure can be adjusted to suit the varying table loads, which, in the case of the largest machine, may be several tons. A turning tool can be mounted on the lower cutter-head to permit taking a cut across the top of the work-holding fixture, which will insure a plane surface for mounting the gear parallel with the top of the work-table.

Another interesting design feature is the use of T-slots in the table. This enables fixtures and gears to be mounted in the shaving machine, with absolute concentricity between the shaved gear tooth surfaces and the table bearing. The hollow table design permits the gear to be located in the same position and on the same face as in the preceding hobbing operation in which the gear teeth were generated.

Maintenance of accuracy to 0.0003 inch in leveling the entire machine is achieved through the use of a strain gage which checks and keeps uniform the strain on each leveling jack, in conjunction

with the leveling pads and a sensitive spirit level. Thus the original assembly set-up can be duplicated exactly at the user's plant and maintained continuously thereafter.

Kearns "Optimetric" Jig Mill

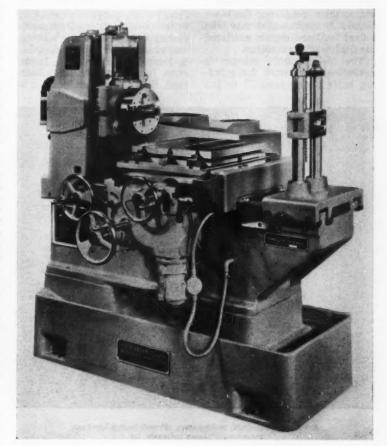
A Kearns "Optimetric" jig mill of somewhat smaller size than most machines of this type is being placed on the American market by the International Machinery Division, British Industries Corporation, 164 Duane St., New York 13, N. Y. This optically controlled machine is adapted for use in tool-rooms and experimental departments, or wherever very accurate surfacing, boring, or milling operations must be performed frequently in producing a variety of small components.

Although designed for a wide range of precision work, the machine is extremely simple to operate. Its optical measuring system provides an accurate means for determining the different movements of the work-table and the spindle-slide.

The arrangement for both vertical and transverse motions is the same, a glass scale being optically projected on a large ground-glass screen. With this arrangement, settings can be made that are accurate within 0.00025 inch. The large ground-glass screen, 4 by 1 1/2 inches, is designed for easy reading.

The spindle is driven by a 1 1/2-H.P. motor in the base. Special ways are provided on the bed for the boring-bar support, which is of the central thrust type. The bearing of this support has the same vertical traverse as the spindle-slide.

The compound table has three reversible power feeds for transverse and longitudinal motions, provided by a constant-speed 1/4-H.P. motor. Fine and coarse hand feeds with independent hand-wheels are provided for obtaining the required feeding movements in both directions.



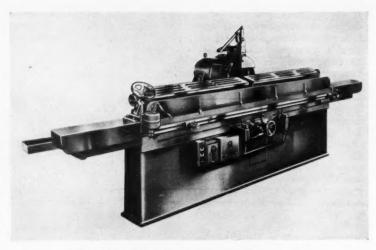
Kearns small size "Optimetric" jig mill introduced in this country by the British Industries Corporation

Hanchett Precision Knife Grinder with Automatic Table Drive

The Hanchett Mfg. Co., Big Rapids, Mich., has announced a Model "DN" precision knife grinder having an automatic table drive transmission that incorporates the latest design of timing belt drive. This drive is said to be positive, quiet, and non-slipping. The rack pinion shaft is mounted on roller bearings and the idler shaft on precision ball bearings to insure accurate alignment, rigidity, and smooth table operation.

Forced-feed lubrication is provided for the table ways. Both flat and vee ways are ground to precision tolerances, lapped, and hand-scraped. All base castings, fabricated steel bases, and parts are subjected to the Hanchett normalizing treatment in a specially developed oven that holds 30,000 pounds of material per charge. The castings are gradually heated to a temperature of approximately 1200 degrees F. and then allowed to cool off slowly to normal temperature. This treatment relieves all internal strains and stresses, rendering the bases completely inert so that they take a final "set" and remain unaltered for the life of the machine.

The Model "DN" grinder is available in capacities for grinding knife blades from 32 to 108



Precision knife grinder with automatic table drive transmission announced by the Hanchett Mfg. Co.

inches in length. There are other models also for handling heavyduty work from 32 up to 360

inches in length, with spindle motors from 2 up to 40 H.P. dependent upon requirements.

Ipsen Automatic Washer Units Designed for Rapid Metal Cleaning

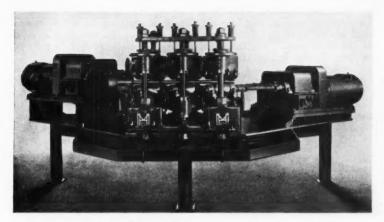
A new line of compact, forcedcirculation washers in three different sizes, designed to speed up metal cleaning through automatic cycling and by combining washing and rinsing in a single operation, is being offered by Ipsen Industries, Inc., 715 S. Main St., Rockford, Ill. The units are adapted to production line operation, as well as to a wide variety of standard degreasing and oil removal jobs.

By employing an automatic surface spray skim-off, the singlestage units are said to eliminate the need for secondary washing and extra work-handling operations. When used with recommended detergent compounds, it is claimed that work-pieces are thoroughly cleaned 50 per cent faster than with ordinary washing methods. For average load conditions, a total cycle of five to seven minutes is sufficient. Solution temperatures, work-handling, and cycles for solution circulation are controlled automatically.

The welded steel units are available in load capacities of 300, 400, and 700 pounds. Loading platforms are swivel type roller units, and can be attached to either end of the washer for in-and-out operation, or to both ends for straightthrough operation. Platforms have solid pans to catch drippings. Solution heating is provided by immersion elements available for gas, electric, or steam heating. Temperatures are controlled by an aquastat, and can be varied to fit the requirements of load and condition of work-pieces. When the skim-off spray has cleaned the surface, the load is automatically raised to the load-unload position for draining and drying.



Automatic washer with surface spray skim-off feature has been announced by Ipsen Industries, inc.



Mackintosh-Hemphill improved tube and pipe straightener with shield removed to show straightening rolls

Rotary Tube and Pipe Straightening Machine of Improved Design

The Mackintosh-Hemphill Co., 901 Bingham St., Pittsburgh 3, Pa., has made several important design improvements in their Model AX tube and pipe straightening machine. The straightener, its two 3-H.P. motors, and the drive spindles are now mounted as a unit on a steel table. Although bolt holes in the table feet facilitate permanent installation on production lines, the complete unit can be quickly relocated to suit changes in shop lay-outs.

A circulating flood lubrication system for the six driven rolls of the straightener is now an integral part of the machine design. Experience gained with the earlier machines in a variety of plants, especially those producing aluminum and other non-ferrous tubing, indicated that the best results can be obtained with a petroleum-base liquid lubricant.

In the case of this machine, provision is made for directing the lubricant at the points where the tube or pipe is in contact with each pair of rolls. This materially improves the straightening action. dissolves the residue of the solutions used in the drawing operations, washes away metal particles which might mar the tube surface, and lengthens the roll life. A steel shield deflects any splashing lubricant into the collecting tray. This shield has two shatterproof glass inspection windows; and two handles are provided to facilitate removal of shield.

Another safety feature is the provision of covers for the six drive spindles. The covers completely shield the fast-spinning drives, and are hinged to allow ample space for spindle servicing. Where volatile lubricants are used, explosion-proof motors are standard equipment for driving the straightener rolls and for the lubrication system.

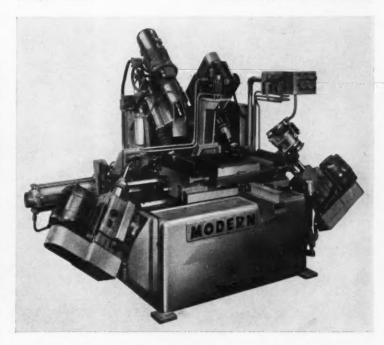
This guideless rotary straightener has the capacity to straighten tubes or pipe from 1/4 inch to 1 1/2 inches in diameter. Its production speed is variable up to 350 feet per minute.

Four-Way Transfer Machine for Drilling and Tapping Cylinder Blocks

A four-way transfer machine which will drill and tap forty-five automotive engine cylinder blocks an hour has been built by the Modern Industrial Engineering Co., 14230 Birwood Ave., Detroit 4, Mich. Operations include drilling the oil-holes that run at compound angles from the camshaft main bearings to the oil gallery hole, and drilling and tapping a hole in the pan rail on one side of the block.

The cylinder blocks are brought to the machine on a roller convevor, and are transferred to a fixture that has been shuttled out and into a convenient loading position. The block is located on the fixture from the pan rail and two locating holes. As the fixture is shuttled back into the drilling position, an air-operated clamp presses against the top of the cylinder block, holding it securely in the fixture against the upward drilling pressure. Simultaneously, the locating pins move up into the two locating holes.

When the fixture and cylinder block are in position, the cyclestarting button is pushed to energize two of the drill-head units. One unit drills an oil-hole while the other drills and countersinks



Transfer type machine for rapid drilling and tapping of cylinder blocks developed by Modern Industrial Engineering Co.

the hole to be tapped in the pan rail. When these units retract after drilling, the fixture is automatically shuttled to the left and locked in position for the next operation.

Another drill head and a tapping head then automatically begin their operations of drilling the second oil-hole and tapping the hole in the pan rail simultaneously. As soon as these holes are finished, the drill head and tapping head retract, and the fixture and cylinder block are shuttled back

to the loading position, where the air clamp is released and locating pins are stripped from the block at the same time. Then the block is transferred automatically to the roller conveyor, and another loaded into the fixture.

Two 1-H.P. motors, one 1 1/2-H.P. motor, and one 1-H.P. brake motor are used to drive the machine components. The machine is 108 inches wide by 72 inches deep. The over-all height is 80 inches, and the weight approximately 7500 pounds.

tain is attached to the door and the other to the roof deck in such a manner that the curtain rolls up and down with the door.

The work conveyor drive on the

by castings. One end of the cur-

The work conveyor drive on the barrel has been provided with an automatic torque throw-out arm to eliminate the possibility of damage to the equipment in case of jamming. Power for the work conveyor drive is supplied from a separate motor. Anti-friction roller bearings are used at all points where shafts carry loads.

A quick-acting work loader delivers the entire load into the machine with the least possible drop, thus reducing casting breakage. The discharge angle is such that even flat pieces of work will not become caught on the loader. The 3-cubic foot machine is powered by two 1/2-H.P. motors and one 11/2-H.P. motor, the 18-cubic foot machine by two 11/2-H.P. motors and one 15-H.P. motors and one 15-H.P. motors

Pangborn Airless "Blastmaster Rotoblast" Barrels

The airless "Blastmaster Rotoblast" barrel which was recently brought out by the Pangborn Corporation, 1200 Pangborn Blvd., Hagerstown, Md., in 6- and 12-cubic foot capacity sizes is now available with 3- and 18-cubic foot capacity barrels. These new machines, designated 3GN and 18GN, include in their design all of the construction features which have proved advantageous in the other sizes.

One of the most important features of the barrel is the abrasivetight door of all metal construction which can be moved up and down by an easily operated crank. A heavy rubber curtain between the door and the area in which the blasting takes place protects the door from flying abrasive and prevents it from being damaged

DoAll Mammoth "Monolight" for Optical Inspection

A monochromatic light generator with a 20-inch diameter, highintensity light source, said to be the largest on the market, has been brought out by the DoAll Co., 254 N. Laurel Ave., Des Plaines,



One of two new sizes of "Blastmaster Rotoblast" barrels manufactured by the Pangborn Corporation



Huge "Monolight" for use in optical flat inspection work has been brought out by the DoAll Co.

Ill. This instrument was developed to meet industrial demands for greater capacity, so that big parts or a quantity of smaller parts could be checked more easily and rapidly for surface flatness, finish, dimension, etc. This "Monolight" is intended to facilitate the use of large optical flats, up to 10 inches in diameter, which are now being marketed by the company.

The 24-inch work height capacity of this light generator permits parts of considerable thickness to be inspected. Sizable quantities of parts can also be checked more easily on the 30- by 30-inch work-table, which is completely blanketed by the monochromatic

light. Groups of parts to be checked with optical flats can be allowed to normalize right at the light source.

The Monolight is said to have many applications in industries where lapped metal surfaces are being used more and more to provide tight metal-to-metal seals. It is especially adapted for use in the automotive industry for checking lapped surfaces on hydraulic transmissions, or in pump and refrigerator manufacturing operations for checking lapped surfaces in pumps and compressors. In the optical manufacturing industry, the instrument can be used for checking the curvatures of lenses.



Apex disc sander and grinder

Bliss Single-Geared Trimming Press

Development of a new line of single-geared trimming presses featuring streamlined box type crown construction is announced by the E. W. Bliss Co., Canton, Ohio. These presses are especially

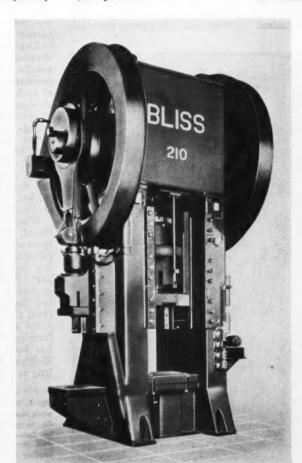
designed for rigidity and quiet operation. They are of four-piece welded steel frame construction with twin herringbone driving gears which run in oil and are equipped with oil-tight gear guards.

oil-tight gear guards.

Among the features of the No. 210 trimming press illustrated are an air counterbalance concealed in the uprights. automatic lubrication and the Bliss fast-acting, cool-running friction clutch. Another important feature of this press is the friction clamp slip type knock-out which prevents accidental breakage of dies or other parts by permitting the friction clamp to slide on the knock-out bar whenever the bar has not been adjusted to the proper height.

Operation of the press is at a speed of thirty-five strokes per minute and the ram capacity is 440 tons. The slide has a 16-inch stroke with a motorized adjustment of 6 inches, and the trimming attachment has a 10-inch stroke

with a 4-inch adjustment. The press is about 18 feet high above floor level and requires a floor space 94 inches long by 86 inches wide, and weighs approximately 98,000 pounds.



Trimming press of new line announced by E. W. Bliss Co.

Disc Sander and Grinder

An Apex 20-inch disc sander and grinder is being introduced on the market by the Rankin Bros.

Precision Machine & Tool Works, 11090 S. Alameda St., Lynwood, Calif. A new feature of this machine is a reversing switch with motor overload protection which permits efficient surfacing of right- and left-hand jobs, and is claimed to extend the life of sanding discs as much as 30 per cent.

A handwheel provides means for tilting the table to any angle up to 45 degrees, either upward or downward. A protractor is provided to assure accuracy. Another handwheel is used to move the table down 11 inches to expose the entire disc. There is a miter gage which can be set for angles up to 90 degrees in either direction. The hazardous table slot is filled by a safety bar. When work strikes the disc guard, the guard tilts back, allowing full use of the 20-inch disc surface. A similar model is available with a 16inch disc. The sanders can be used for plastics as well as metal.

"Hidraw" Deep-Drawing Press Using Combination **Cushion and Rubber Pad Process**

A combination cushion and rubber pad process-known as "Hidraw"-has been incorporated in a 7000-ton hydraulic press for deep-drawing metal parts built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. The "Hidraw" process was developed and perfected by the Consolidated Vultee Aircraft Corporation, Fort Worth, Tex. Engineers of both companies in cooperation with those of other aircraft manufacturers have added design features to this press which adapt it for Guerin and die quenching operations.

An outstanding advantage claimed for the "Hidraw" process is the practically perfect surface finish obtained on the drawn part. This is made possible because the part is in contact with rubber and the punch member of the die only while the drawing operation is being performed. Since the part is formed by fluid pressure without an ironing operation, it has walls of uniform thickness and is subjected to minimum stretching.

Parts with a contour difficult to produce can be formed directly from the blank to the finished part because the rubber acts as a fluid pressure medium and there is no unsupported metal between the point of contact with the punch and the actual draw-ring itself. Inexpensive tooling is another advantage of the process, especially where there are thousands of parts and small production lots. Hand work to remove wrinkles is also eliminated.

Cross-sectional views through cushion, pins, bolster, punch, blank-holder ring or plate, blank, and pad shown in Fig. 2 illustrate the "Hidraw" process step by step. The blank to be drawn is placed on the blank-holder plate, which is flush with the top of the punch, as seen in view A. The descending platen automatically slows down just as the pad contacts the blank to prevent deforming the work. As the platen continues to descend, pressure is generated in the rubber pad, which grips the blank between its face and the blankholder plate illustrated in view B. The exact pressure generated in the pad is determined by the pressure developed in the hydraulic cushion in the press bed which, in turn, supports the blank-holder plate on pins extending through the press bolster plate.

The pressure generated in the rubber pad forces the blank down over the punch so that it conforms to the contour of the punch, view C. At the same time, the blank is clamped between the surface of the rubber pad and the blankholder ring, thus preventing wrinkles from being formed. The rubber acts as a fluid pressure, insuring the production of a drawn part which conforms to the contour of the punch. Pressure exerted by the hydraulic cushion controls the forming pressure developed in the rubber pad, and is adjustable to a pre-set stroke pattern as required by the form of the part being drawn and the tensile strength of the metal. Rubber pressures ranging from

ployed for this process. Although aircraft parts of stainless steel and alloys of high tensile strength require high pressure, from 90 to 95 per cent of such parts used in present-day airplane designs can be formed at pressures not in excess of 6000 pounds per square inch. For larger parts in which contour radii are, as a rule, more liberal, it is possible to use lower pressures successfully. Trimming of the drawn part can be accomplished by providing a sharp

4000 to as high as 10,000 pounds

per square inch have been em-

shoulder on the punch.

When the draw has been completed, the platen automatically reverses. The blank-holder plate remains in the down position until the pad has cleared the drawn part. Pull-back pressure is then applied to the die cushion in the bed for ejecting the drawn part from the punch. Automatic slowdown at this point prevents deforming the drawn part before it has been freed from the punch. Multiple parts can be drawn as long as they are approximately the

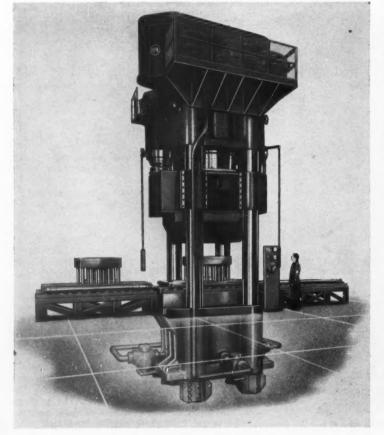


Fig. 1. Artist's conception of deep-drawing press recently built by Hydraulic Press Mfg. Co. to apply "Hidraw" process developed by Consolidated Vultee Aircraft Corporation. Illustration shows two-station workloading tables arranged for assembly and dismantling of "Hidraw" tooling on tables in the out position

Fig. 2. Cross-sectional views of the punch. cushion, rubber pad, and associated parts, showing step-by-step operation of the "Hidraw" process

same depth, an important factor in saving tool costs.

Loading tables are available in two- and four-station types which have sufficient carrying capacity to move the largest pad container in and out of the press with a minimum of auxiliary handling facilities.

"Brammertool" for Installing and Adjusting V-Link Belting

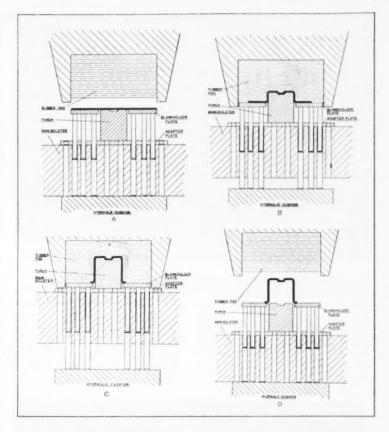
A prong type device called the "Brammertool"-designed to simplify attaching and detaching sections of the Brammer V-link belt described in June, 1952, MACHINERY, page 232-has been developed by the Brammer Corporation, 684 Broadway, New York 12, N. Y. Only a light pressure is required to insert the prongs of this tool into slots in the V-links of the belt. Twisting the tool then opens up the slots so that the rivet heads can be slipped in or out quickly to make or break connections in the belting.

Vard Line of Machine Tools

Four machine tools developed and used by Vard, Inc., Pasadena, Calif., in its own plant for the manufacture of ball screws, screw actuators, electric motors, electromechanical actuators, gears, and gear boxes are now being placed on the market. These machines, now in full production, are an hourglass worm grinder; a special thread grinder; a multiple-spindle hydraulic boring machine; and the hydraulic production milling machine shown in the illustration.

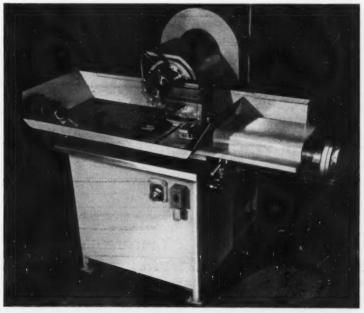
Vard hourglass worm grinder is designed to provide an accurate hob and hobbing method for cutting mating gears, and for producing worms and gears of accurate geometrical shape without recourse to lapping. Electrically controlled micro switches enable automatic reversing and continuation of forming operation as required.

Second in this line of machines is a special thread grinder which features a master lead-screw that facilitates precision grinding of all kinds of threads in lengths up

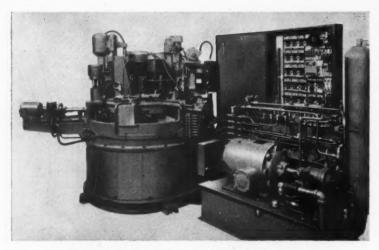


to 22 feet without resetting work. The multiple-spindle hydraulic

and maintains consistent tolerances of 0.0004 inch on bores. Presboring machine performs multiplesure-fed coolant oil is ejected step boring and facing in one through the center of each spindle operation, affords high production, and, when necessary, controls still



Vard horizontal milling machine powered by air-hydraulic system



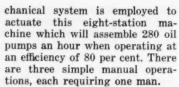
Dayalas machine for semi-automatic assembling of oil pumps

closer tolerances through temperature graduations of the coolant.

Fourth in this line of Vard machine tools is the horizontal milling machine designed to perform heavy face-milling up to a 1/2inch cut on No. 4130 heat-treated steel. This unit is powered by an air-hydraulic system.

Semi-Automatic Machine for Assembling Oil Pumps

A semi-automatic, hopper fed, oil-pump assembling machine has been placed on the market by the Douglas Tool Co., 2300 E. Nine Mile Road, Hazel Park, Mich. A combination hydraulic and me-



Pump bodies are loaded and finished assemblies unloaded by one man. At the first station, the pump body is automatically clamped in place. The second station remains idle. A hopper feeds in the idler gear shaft at the third station where the shaft is pressed into place. The shaft is automatically checked for proper alignment at the fourth station where it is either accepted or rejected. Dowel-pins are hopper fed into position and pressed in at the fifth station.

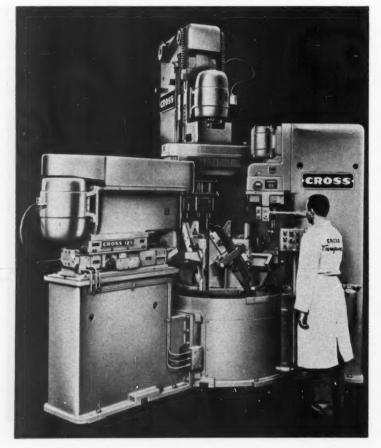
An operator at the sixth station inserts the idler gear, drive-shaft, and gear assembly, and puts a gasket in place. At the seventh station, the operator puts the cover on the oil pump and starts four cover screws. The cover screws and the pressure relief valve nut are automatically tightened to the correct torque values, at Station 8. When these operations are completed, the machine unclamps the oil pump, which is ready for removal by the operator at the first station.

Cross Machine for Finishing Manifold Pads on Six-Cylinder Engines

A special machine for milling, boring, drilling, chamfering, and tapping the exhaust manifold tail pipe pad for six-cylinder engines has been built by The Cross Company, Detroit 7, Mich. The five operations can be performed by this machine at the rate of 120 pieces per hour. The parts are held on a fluid, motor-driven indexing table which has six stations-one for loading and unloading, and one each for milling, boring, drilling, chamfering, and tapping.

Hydraulic and electrical construction is held to Joint Industry Conference standards. The machine has hardened and ground ways, hydraulic feed and rapid traverse, individual lead-screw feed for tapping, and automatic

lubrication.



Special machine equipped for operations six-cylinder engines brought out by The Cross Company

Wet-Blasting Machine

The addition of a Model 30 "Liquamatte" to its line of wetblasting machines has been made by the American Wheelabrator & Equipment Corporation, 1147 S. Byrkit St., Mishawaka, Ind. This machine is intended for precision cleaning and finishing of small pieces that can be lifted and handled manually, such as small stamping dies, die-casting dies, and drawing dies; glass, plastic and rubber molds; drills, reamers, and taps; and many other parts being manufactured, reconditioned, or serviced. The machine has a blasting compartment 30 inches square by 2 feet 7 inches high. A rotating table holds the work in the blasting compartment shown in the right-hand view of the illustration.

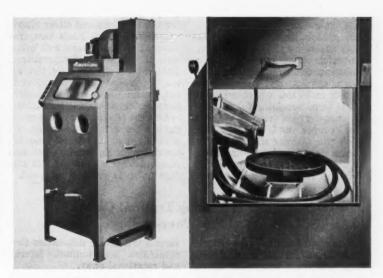
Fine mesh abrasives, suspended in water, are propelled at the work by compressed air. The abrasive slurry is made up of 25 pounds of abrasive and 5 gallons of water. Fine-mesh abrasives ranging from 80 to 2500 mesh can be used to maintain close-tolerance dimensions and keep corners, lines, and lettering in patterns undamaged. Flat surfaces, knurling, thinwalled sections, and other normally vulnerable areas are said to remain unchanged. Tolerances of 0.0001 inch can be maintained where required.

The Model 30 Liquamatte has one set of armholes on the front of the cabinet. The operator manipulates the abrasive gun toward the work with his hands while actuating the compressed air valve with his knee. When blasting is finished, the work is rinsed in a two-compartment auxiliary tank. Ferrous parts are rinsed in inhibited water. Immersion heater units are available for the water, so that parts dry faster and there is less chance for oxidation.

Automatic Drilling, Assembling, and Crimping Machine

The manufacture of a specially designed automatic assembling, crimping, and drilling machine has been announced by Turner Bros., Inc., 2625 Hilton Road, Ferndale, Michigan. This novel machine has been engineered and

Machine for automatic drilling, assembling, and crimping operations, announced by Turner Bros., Inc.



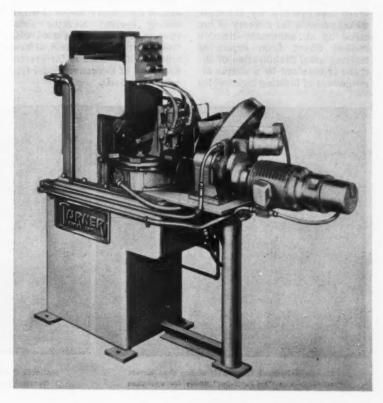
Wet-blasting machine announced by American Wheelabrator & Equipment Corporation, with view of blasting compartment of machine at right

constructed to perform automatically a series of operations beginning with the automatic hopper loading of a breather nut. Intermediate operations include insertion of a baffle, crimping of the baffle, and drilling of the nut. The complete sequence of operations ends with the automatic ejection of the assembled unit. The ma-

chine has been designed to economize on floor space as well as manpower.

New Metal-Cutting Agent

A metal-cutting agent known as "Metalloid WOS" has been developed for all machining and grinding operations by the Metal-



loid Corporation, Huntington, Ind. This product is soluble in both water and oil, and is an odorless, non-toxic, sulphur-free organic condensate containing chlorine, nitrogen, oxygen, and carbon in a complex molecule. The material is said to be non-staining for ferrous and non-ferrous metals, except some copper and brass alloys which will discolor slightly if the product is allowed to remain on the work for a period in excess of twelve hours. It is completely safe

for use on silver and silver alloys.

Metalloid WOS holds temperatures of tool and work well below critical annealing temperatures. This is accomplished by the release of free atoms at the point of cut, which unite with the active metal to cause embrittlement and reduce the plastic flow of the metal during the cutting operation. As a result, tool and work-piece remain cooler, internal stress and distortion are eliminated, and surface finish is greatly improved.

Stabilized No-Swing Tramrail Crane and "Saf-Powr-Bar"

A tramrail crane that eliminates the usual swinging of a load while it is being hoisted or transported will be featured by the Cleveland Tramrail Division of the Cleveland Crane & Engineering Co., 5426 E. 282nd St., Wickliffe, Ohio, at the forthcoming Materials Handling Exposition in Philadelphia May 18 to 22. Elimination of load swing is said to be of great help in speeding tankdipping operations such as anodizing, chromium-plating, and similar operations. The stabilizing feature can also be used to advantage in various assembly operations, since parts or assemblies can be held in a fixed position. When used in a foundry, the crane makes possible the delivery of hot metal by an automatic dispatch method direct from cupola to molding area. Stabilization of the crane is obtained by a simple arrangement of hoisting ropes which

form a triangular suspension that eliminates longitudinal, lateral, and rotational sway.

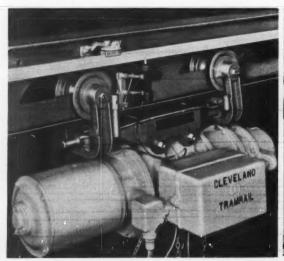
A new "Saf-Powr-Bar" safety type electrified conductor bar will also be displayed. All runway and crane conductors are designed to prevent accidental contact with the electrified conductor bar. Shocks and more serious injuries from contact with power bars are prevented because the bars are enclosed with an insulating cover. This is also a fire preventive feature for use in areas where there are wood dusts or similar combustible materials.

As shown in the illustration, "Saf-Powr-Bars" are inverted U-shaped conductors, inside of which sliding current collector shoes operate. The collectors used with "Saf-Powr-Bars" are said to have a proved life which is far greater than that of the conventional type collector wheels.

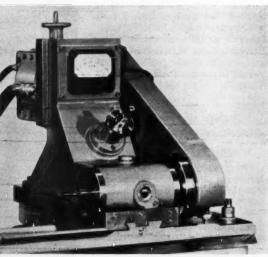
Hanson-Whitney Thread-Milling Machines with Hydraulic Head

The Hanson-Whitney Division, Whitney Chain Co., Bartholomew Ave., Hartford, Conn., has brought out a precision hydraulic threadmilling machine in four sizes—4 by 9, 10 by 24, 15 by 30, and 20 by 48 inches. The hydraulic head shown in the illustration is an outstanding feature of this all-hydraulic machine. In initial tests the machine is said to have greatly reduced production costs, increased cutter life, and given improved finishes. The tests also showed an increase in production rates.

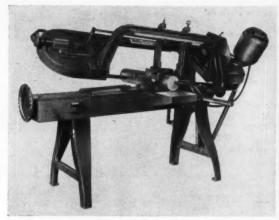
The unusual application of adjustable speed hydraulic motors to the cutter-spindle and workspindle drives is claimed to permit a balancing of cutter speed and work feed which will give the best cutting condition for the material handled. It also provides for the use of carbide cutters. Adjustments can be made instantly during the operating cycle so that no time is wasted in finding the best spindle speed. The spindle speed is infinitely variable up to 3000 R.P.M. Hydraulic power developed from an independent pressure plant is also applied to other units of the machine, such as the work chucking and carriage movement mechanisms. Maximum operating speed is 10 cycles per minute. All actions are performed automatically except for handling of work-pieces.



Cleveland Tramrail crane with sliding shoe current collector in a "Saf-Powr-Bar" ready for operation



Hydraulic thread-milling machine brought out by the Hanson-Whitney Division, Whitney Chain Co.





Wells band saw designed to use high-speed steel blades

"Airetest" indicator for precision tool-room measuring

Band Saw Designed to Use High-Speed Steel Blade

A horizontal band saw, brought out by the Wells Mfg. Corporation, 404 S. Grant, Three Rivers, Mich., is said to utilize the new Milford Rezistor high-speed steel band-saw blade to advantage. Design features of the band saw include heavy-duty counterbalanced frame and beam; new style band wheels which provide for the use of 1-inch wide blades; constant-load blade tensioning device; and synchronized speed blade-cleaning brush.

This machine was developed especially for use with the Milford Rezistor blade—it being claimed to have established new records for greater cutting efficiency and number of cuts per blade, particularly in cutting stainless steel—but can also be employed with

standard carbon steel blades. The machine has a capacity for cutting bars up to 8 inches in diameter.

Sheffield "Airetest" Indicator

An "Airetest" indicator for the precise measurement of critical dimensions normally encountered in tool-room work is being marketed by the Sheffield Corporation, Dayton 1, Ohio. This simple, rugged, super-sensitive air height gage has adequate amplification, is easily calibrated, and gives positive repeat readings from the front, back, or either side. The instrument is free from hysteresis, and a movement of only a few millionths of an inch is instantly indicated.

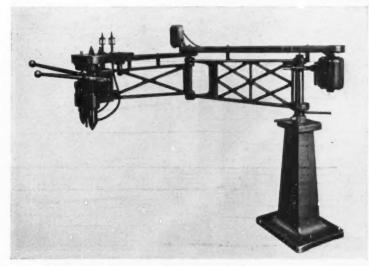
The equipment regularly con-

sists of a pick-up arm mounted on a beam which actuates an air jet connected to a 1000 to 1 or 2000 to 1 amplification Precisionaire gage. Provision for 5000 to 1 amplification can be made if necessary. A screw permits fine adjustment. This height gage can also be used in static strain gages, in dynamic strain gages with a recording unit, as a center pick-up unit in such machine tools as jig borers, and as an indicator for various types of lead testers and gear checkers. It serves as a master testing device to accurately determine flatness, parallelism, concentricity, and other geometrical features of parts which are resting on a surface plate, clamped in the correct relative positions on a surface plate, or rotated on precision centers or in V-blocks.

The pencil slim design permits this device to be used in holes, slots, and grooves in which it would be impossible to use conventional indicators because of interference with the dial face, or because of the short distance from the stylus to the dial face.

Double-Spindle Radial Arm Drilling Machines

Ekstrom, Carlson & Co., Department M-4, 1400 Railroad Ave., Rockford, Ill., has recently added a number of double-spindle machines to their line of radial arm drills. These new Type DS machines are especially designed for the aircraft industry, and are said to be particularly adaptable to aircraft production requirements. They are available in two sizes, with three models in each size. All six models have a fixed center-to-



Double-spindle radial arm drill brought out by Ekstrom, Carlson & Co.

center distance of 6 inches between drill spindles, and they also have the following identical specifications: dual spindle speeds of 5000 and 8000 R.P.M., maximum vertical spindle travel of 4 1/2 inches, maximum vertical turret post adjustment of 6 inches, drill chuck capacity up to 3/8 inch, and 1-H.P. spindle drive motors.

The No. 30 DS machine has a 30-inch radial reach, while the No. 71 DS has a reach capacity of 71 inches. Any of these models can be supplied with a gravity feed lubricating system.

Hero Plain and Universal Milling Machines

A Hero plain or universal type milling machine redesigned with a larger table is being introduced in this country by the Morey Machinery Co., Inc., 410 Broome St., New York 13, N. Y. This model was brought out in response to a demand for a larger table capacity than that of the preceding models available. The dimensions of the new table are 39 1/2 inches long by 9 1/4 inches wide. Six longitudinal power feeds are another feature of the new table. The machine is equipped with anti-friction bearings, has twelve spindle speeds, and is supplied with a 2 1/2-H.P. motor.

Improved Di-Acro Power Bender

Improvements in the design of the Di-Acro hydraulically operated bending machines to more evenly distribute the stresses and to keep mechanical distortion to a minimum have been announced by the O'Neil-Irwin Mfg. Co., 559 Eighth Ave., Lake City, Minn. It is claimed that changing the design of the bending table from fabricated steel to a strongly ribbed alloy casting provides greater strength and also allows the gear housing to be assembled in the casting in a manner to assure positive alignment at all times. Other improvements include the addition of foot controls to facilitate material-handling and work-positioning; replacement of a 2-H.P. motor with a 3-H.P. motor; and the use of 1/4- to 1/2inch steel plate instead of sheet fabrication on the cabinet, which results in improved rigidity.

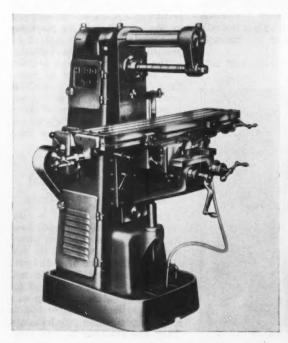
The Di-Acro power bender is an all-purpose machine which can be used for forming simple and complex bends in round stock, tubing, angles, channels, moldings, strip stock, extrusions, and many other ductile shapes. It is possible to perform bending operations in either a clockwise or a counterclockwise direction by making a few simple adjustments.



Carbide tool grinder equipped with

Prosser Carbide Tool Grinder Equipped for Wet-Grinding

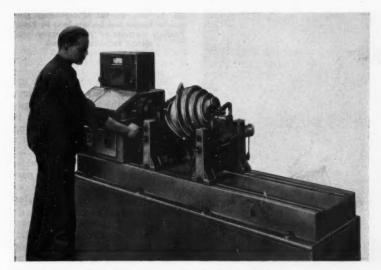
Thomas Prosser & Son, 120 Wall St., New York 5, N. Y., have added a moderately priced Model AW wet grinder to their line of tool and cutter sharpening machines. This wet grinder for sharpening carbide tools embodies



Hero milling machine introduced in this country by the Morey Machinery Co., Inc.



Di-Acro power bender of improved design brought out by the O'Neil-Irwin Mfg. Co.



Schenck electrodynamic balancing machine

all of the features of the Model AA machine, including the quickacting indexing tables which can be accurately and securely set to the required angle.

The machine is provided with a separate motor-driven coolant pump, pan, settling tank, piping, valves, nozzles, and spray guards. A copious flow of water is supplied directly to the tool being ground. A 1/2-H.P. motor for 110-volt, 60-cycle, single-phase, or 220-to 440-volt, 60-cycle, three-phase current is furnished as standard equipment.

Adjustable-Speed Drive for Rogers Vertical Turret Mill

An adjustable-speed drive for their "Perfect 36" vertical turret mill has just been announced by the Rogers Machine Works, 1400 Seneca St., Buffalo 10, N. Y. This drive provides stepless adjustment of table chuck speeds up to 212 R.P.M. The power unit governs the motor speed, eliminating the eight-speed transmission, clutch, brake, and lever controls on the standard machine.

The independent speed control box is equipped with rheostat control and provides a speed ratio of more than 16 to 1. Speeds may be changed while the machine is in operation. The motor provided with this drive is designed for adjustable speed service, and can be started and stopped without changing the speed setting. Dynamic braking for quick stopping is controlled by a stop button.

The Rogers "Perfect 36" verti-

cal turret mills are equipped with an adjustable five-position vertical turret for boring, drilling, reaming, turning, and thread-cutting. A quick-acting lever permits rapid indexing of the turret head.

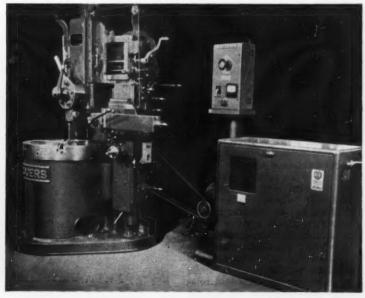
Provisions are made for an adjustable swing up to 35 degrees each side of the vertical position, in addition to left to right and up and down adjustments for the main vertical slide. The special swivel side head provides for settings at any angle up to 35 degrees each side of horizontal, as well as up and down and left and right adjustments. The square turret in lexes to eight positions.

Electrodynamic Balancing Machines

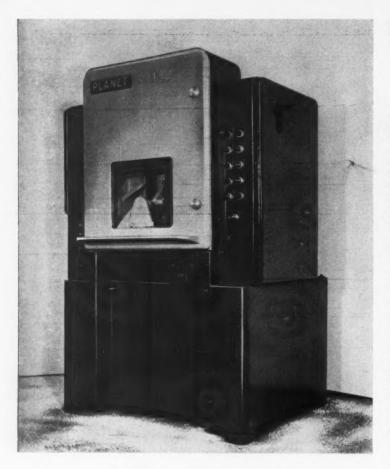
Nine different models of Schenck electrodynamic balancing machines are now being marketed in the United States by the Cosa Corporation, 405 Lexington Ave., New York 17, N. Y. These German-made machines are said to accurately determine the amount and location of dynamic and static unbalance in rotating parts in less than a minute. The various models have weight capacities which range from a few ounces, in the smaller machines, to over 100 tons.

Each balancer has an electrical measuring system, without electronic tubes or oscillograph, that will indicate unbalances that are caused by displacements amouning to as little as 0.00004 inch from the center of gravity. Such measurements are indicated on a wattmeter that records only unbalanced vibrations and is unaffected by disturbance vibrations of other frequencies.

In many installations, these balancers are combined with machine tools to check, correct, and inspect parts in one set-up. The weight of rotating parts that these machines can handle ranges from 0.1 pound to 22 pounds for the smallest machine up to 1100 to 220,000 pounds for the largest size. Even the smallest pieces are balanced easily by adding or removing weight units at two of the four balancing points located within the coordinates, 90 degrees apart.



Rogers vertical turret lathe equipped with new adjustable-speed drive



Abrasive-Belt Form-Generating Machine for Grinding Gas-Turbine Blades and Buckets

The Planet Products Corporation, Cincinnati, Ohio, in cooperation with Metcut Research Associates, also of Cincinnati, have designed and built two gasturbine blade and bucket grinders for the Metals Processing Division, Curtiss-Wright Corporation, Buffalo, N.Y. These machines are equipped to handle "Sapphire" turbine rotor and stator parts. They will remove stock from one side of turbine blades at the rate of 0.001 to 0.003 inch per second, so that an average cycle time of less than one minute per side can easily be obtained on parts having the usual stock allowance. An 80grit belt has been used on the rough or "semi-precision" Nimonic (about 80 per cent nickel) forgings to obtain a finish of approximately 50 micro-inches.

The form-generating machine is built in two basic models. Model 4S is for concave shapes, while Model 4T grinds convex and relatively flat surfaces. Hydraulic means is employed to reciprocate

the work-piece on the Model 4T machine and to reciprocate the cam assembly of the Model 4S machine used for concave shapes.

Fig. 1. Machine for form-grinding gasturbine blades and buckets built by Planet Products Corporation in cooperation with Metcut Research Associates

Once the machines are set up, the operator loads a work-piece and presses the master cycle button, after which the operation is automatic except for removing the finished piece and inserting a new one. One part can be loaded into a cartridge or shuttle while another part is being ground, permitting the work to be checked for position or size before or after grinding.

The machines are of unit construction and have a plastic sliding door and shelf, as shown in Fig. 1, to facilitate loading and unloading the work. The method of conjugate form-grinding, with the abrasive belt traveling be-tween the master form and the work-piece, which has been incorporated in these machines is shown diagrammatically in Fig. 2. This diagram illustrates the basic motions of the work and the path followed by the abrasive belt in generating a simple convex airfoil shape. The center circle represents a gear mounted in a fixed position on the axis of the sweep arm. The outer circles show the two extreme positions of a planet gear in mesh with the fixed gear.

The master form generates the desired contour as a result of the specific relative motion between it and the work-piece. This motion is such that progressive contact of limited area results. Under these conditions, a 15-H.P. motor

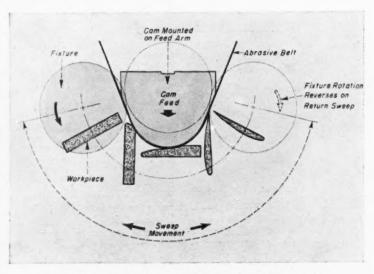


Fig. 2. Diagram illustrating form-generating principle of Planet machine

supplies ample power for rapid metal removal. The sweep unit of the machine equipped for convex forming carries a cradle upon which the work-holding fixture is mounted. The oscillating planetary motion of the work-piece against the master form (with the belt moving between them) enables grinding of the desired conjugate contour. Both the master form and the work-holding cradle are easily removed and tooling is interchangeable between machines. In the Model 4S machine, for concave grinding, the work-holding fixture is mounted on the feedarm. The sweep unit of the concave machine imparts to the master form what is basically an oscillating planetary motion. The work is ground to the desired form as it is fed against the belt, which passes between the work and the moving form.

The shape of the master form for each job is determined right on the grinder. A master blade or bucket is placed in position on the machine, supported in the same way as in the actual engine when possible. Then a blank faced with plastic material is placed in the conjugate form position. Power sweep motion is then employed in conjunction with hand feed control so that the master blade generates its own conjugate form in the plastic.

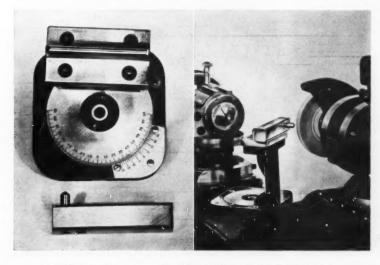
After being reproduced in steel to the required degree of accuracy, the master form is hardened. It is then either surface treated or plated to improve wear resistance. One method involves plating with chromium to a depth of a few thousandths inch. In use, the form is checked at regular intervals by mechanical or chemical means to determine when the plating begins to wear through. When wear reaches a certain point the chromium is stripped, and the form replated. Another method of protecting the master form involves stretching a thin metal sheet over the master form. This sheet may be treated to resist wear and can be replaced easily when it is worn beyond an allowable limit.



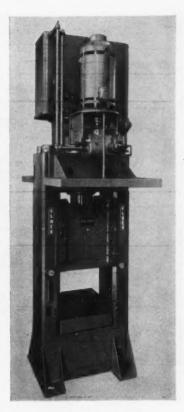
An inexpensive wheel dresser for dressing angles on grinding wheels is announced by the Royal Oak Tool & Machine Co., 29800 Stephenson Highway, Royal Oak, Mich. This dresser has a graduated base and vernier reading to 5 minutes for use in making precision set-ups.

The diamond truing tool is mounted in a hardened steel block. Dressing is accomplished by sliding the block across the hardened and ground surface of the dresser plate.

The dresser plate can be set to any desired angle, and the inverted T-slide permits dressing the wheel on either side. Although specifically designed for use on the D-S bench model radial relief grinder, it can be used on practically all cutter and tool-room grinders.



(Left) Grinding wheel dresser brought out by Royal Oak Tool & Machine Co.
(Right) Dresser shown at left set up for dressing grinding wheel



Elmes pipeless hydraulic press, built for production of shell forgings by new process

Elmes Pipeless Hydraulic Press

A 500-ton hydraulic press designed for cold-drawing and nosing artillery projectiles by what has been termed a "radically different" shell-forging process has been manufactured by the American Steel Foundries, Elmes Engineering Division, 1150-J Tennessee Ave., Cincinnati 29, Ohio. The process is said to represent an efficient and economical compromise between old hot-forging methods and the newest steel extrusion processes. The die space has been made smaller than standard, less area being required because of the intense pressure developed when using this process.

The press embodies the Elmes principle of pipeless construction, there being no piping in the main hydraulic circuit. All highpressure fluid is conducted through short, direct passages drilled in the structural parts of the press. The result is exceptionally smooth, quiet, shockless operation and low-cost maintenance, with practically no "down" time.



Fig. 1. Precision tool-room surface grinder brought out by the DoAll Co.

DoAll Precision Tool-Room Surface Grinder

Centralized control over dimensional sizes and protection of the work from detrimental heat generated by grinding are outstanding features of a series of Model D6 precision tool-room surface grinders brought out by the DoAll

Co., 254 N. Laurel Ave., Des Plaines, Ill. Many new controls and attachments have been developed for these machines to give them exceptional versatility. They are obtainable with longer tables than usually furnished on toolroom surface grinders. For example, the Model D6-3 of this new series has a table with a 6-by 24-inch work area—6 inches longer than the customary length. Full hydraulic cross-feed is standard for this machine.

A new coolant system affords finger-tip control of three cooling methods. The first method, called "cool grinding," consists of applying the coolant to the sides of the wheel so that it flows through the wheel as a result of centrifugal force, emerging as a fine mist at the cutting point. The second method consists of flood cooling, while the third method is a combination of cool grinding and flood cooling developed for use when heavy cuts are taken.

Versatility in coolant control is achieved through a "manifolded" wheel guard shown in Fig. 3. A single hose carries the coolant from the reservoir-pump-filter unit to the guard. Two metering sight feed valves on the manifold, control the flow of coolant to the perforated flanges on each side of the wheel. A third valve on the manifold controls flood grinding. Different combinations of valve settings can be made to provide the most effective cooling for each grinding job.

The front cover of the wheel guard can be raised out of the way, as seen in Fig. 3, to permit removal of the wheel. Also, the

(Continued on page 239)

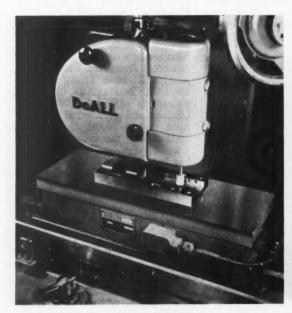
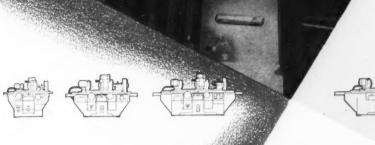


Fig. 2. Spindle attachment of machine shown in Fig. 1 set in vertical position for grinding walls of slot



Fig. 3. Wheel guard of surface grinder seen in Fig. 1 with cover raised to permit removal of wheel

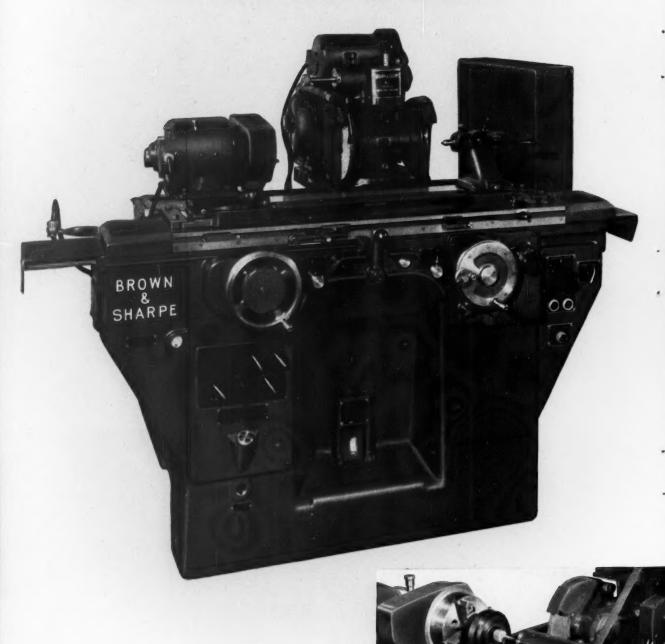
Dramatically
New
from
Every Angle



The
Completely
New Line
of Universal
Grinding
Machines

Brown & Sharpe

New in concept New in versatility, too...



Combination Shoulder and Straight Grinding. Note wheel is mounted on right end of spindle and set at convenient angle. Continuous In-Feed Arrangement (optional) assures accurate, smooth finish on shoulder face. When grinding cylindrical portion of work, the wheel can be fed automatically on each or alternate reversals of table. Separate dwell controls for each reversal assure complete "grind-out" at shoulder without delaying reversal at other end of work.

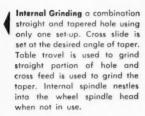


4 Completely New Universal Grinding Machines

In recent years, the broad gap between conventional universal and single-purpose grinding machines has been a serious handicap for many manufacturers. To bridge this gap, Brown & Sharpe now offers a line of completely new Universal Grinding Machines. These machines allow you to instantly combine separate manual operations into automatic cycles for many production applications . . . as well as handle the infinite variety of precision grinding work usually encountered in toolrooms and job shops. Many new and exclusive features provide exceptional grinding flexibility, rigidity, and accuracy. Typical illustrations of their extreme versatility are shown here.

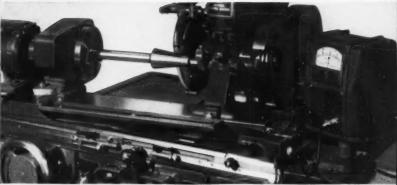
Be sure you know all the advantages of Brown & Sharpe Universal Grinding Machines . . . check the many features on the following page.

Taper Grinding cylindrical work piece. Extremely accurate taper is established and maintained by the Electralign (optional). Small angular adjustments of the swivel table are indicated directly on the amplifier dial.



Grinding Capacities								
Size	Curion	Centers take						
Size	Swing	Nom.	Max.					
1+	10"	20''	223/4"					
2	14"	30"	333/4"					
3	14"	40"	433/4"					
4	14"	60"	633/4"					

*No. 1 machine illustrated



Brown & Sharpe

Ultra-Modern ...Loaded with New and Exclusive Features!

Completely Universal Wheel Spindle Head with instantly available Internal Grinding Spindle permits either external or internal grinding in any desired horizontal position. Accurately graduated compound swivel permits settings for combination straight and taper, or double taper grinding (both external and internal) with only one set-up.

- Double-end, Removable Unit Type External Grinding Spindle
- Greater Flexibility of Grinding Wheel Speeds
- Variable Speed Headstock
- Variable Speed Hydraulic Table Drive Provides Smooth Table Movement
- Table Throttle with Graduated Dial Permits Exact Repetition of Pre-selected Truing and Grinding Speeds
- Unique Universal Turret Provides Extra Work Capacity
- Fine Cross Feed Adjustable to .0001" on Work Diameter
- Positive Stop on Cross Feed for Both External and Internal Grinding
- Conforms to Basic J.I.C. Electrical and Hydraulic Standards



Cross Feed Handwheel automatically combines manual operations . . . can be set to simultaneously control headstock, table, and coolant action; and advances and retracts wheel. You simply move handwheel counter-clockwise to start and return it to original position to stop.

WRITE FOR INFORMATION ON THESE ADVANCED UNIVERSAL GRINDING MACHINES AND THEIR DIVERSIFIED EQUIPMENT.

Brown & Sharpe 185

Milling Machines • Grinding Machines • Screw Machines • Cutters • Machine Tool Accessories

Machinists' Tools • Electronic Measuring Equipment • Johansson Gage Blocks • Permanent Magnet Chucks • Pumps

BROWN & SHARPE MFG. CO., PROVIDENCE 1, R. I., U. S. A.

entire guard can be taken off without removing the wheel from the spindle. The guard can be adjusted to any height with respect to the wheel.

The high-speed spindle attachment shown in Fig. 2 is belt-driven from the grinder spindle. It permits using small-diameter wheels for grinding serrations and T-slots, and for many other intricate grinding tasks. This attachment can be swung from a horizontal to a vertical position for broach sharpening, T-slot grinding, and other grinding applications.

Also available is a cylindrical grinding and indexing attachment which can be used in conjunction with other attachments, such as the high-speed spindle, or alone to grind cylinders, tapers, square or angular punches, and other forms. The attachment has a two-way sine-bar base adjustment for making highly accurate angular settings by using gage-blocks. A twenty-four division index plate is regularly supplied.

Two spindle speed ranges are available. For the low-speed range from 400 to 4000 R.P.M., the grinder spindle is belt-driven by a variable-speed direct-current motor with a Thy-Mo-Trol rectifier and associated control unit. The second speed range is 4000 to 20,000 R.P.M. The grinder may have one range within this overall range, such as 4000 to 16,000 R.P.M. or 5000 to 20,000 R.P.M., but not 4000 to 20,000 R.P.M. A speed indicator is provided with variable-speed surface grinders.

The hydraulic cross-feed indexes automatically at both ends of the table stroke. When the lateral motion of the table is stopped, the cross-feed hydraulic mechanism can be used to move the saddle back and forth under the wheel for wheel dressing, broach sharpening, or slot grinding with the vertical spindle attachment.

Calibrated slip rings on the handwheels can be set at zero after an initial grinding cut and after thickness measurement of the work has been made. Then the required stock can be ground off from literal readings of the handwheel. A motorized column raiser and other controls are available on order.

Arrow "Quick-Lok" Collet Vise

A "Quick-Lok" collet vise designed for precision holding of round parts for such operations as drilling, tapping, milling, threading, and reaming is being manufactured by Arrow Machinists, 41 MacQuesten Parkway North, Mount Vernon, N. Y. This device is said to be exceptionally well adapted for holding finished parts and sub-assemblies. It is especially useful in holding externally threaded rod for drilling or tapping operations.

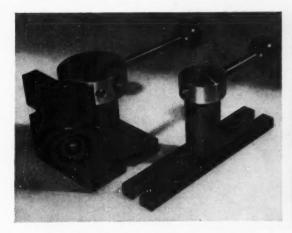
This collet vise is made in two styles, as shown in the accompanying illustration. Each style is also made in two sizes. Both styles are universally adaptable to drill presses, milling machines, surface grinders, etc. The Model No. 3 Economy Jr. is mounted on a ground flat base for vertical use only. It uses standard 3C and 3AT collets in capacities up to 1/2-inch rounds. Model No. 3A Deluxe Jr.

is mounted on an angle-plate for use in either a vertical or horizontal position, and uses the same collets as the vertical model. Models No. 5 Master and No. 5A Master Deluxe are larger sizes of the same designs as the smaller vises. The larger models use any standard 5C collet in capacities up to 1-inch rounds.

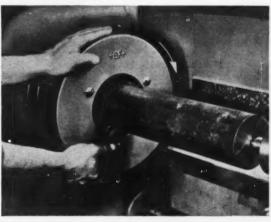
Fisher Line of Lathe Work-Drivers

The Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn., is introducing in this country the George Fisher line of patented lathe work-drivers which are designed to replace work-dogs. These drivers consist of three eccentric jaws (six on the largest size) which have a floating spring action designed to accommodate smooth or rough bars.

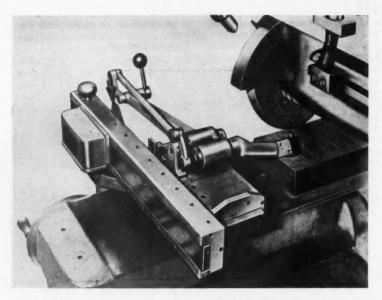
The smooth protective hood covers the mechanism and acts as a manual opening and closing device for the jaws. A slight counter-clockwise turn of this hood opens the jaws and holds them open to permit placing work between centers. A clockwise turn of the hood releases the jaws to grip the work. Any increase in tool pressure and spindle speed automatically increases the holding power of the driver. Jaws are easily reversed to suit direction of spindle rotation. Sizes of drivers have an extremely wide work diameter range. The smallest driver of the five standard sizes has a capacity range of 1/2 inch to 1 1/16 inches, while the largest has a range of 4 7/8 to 8 1/16 inches.



"Quick-Lok" collet vises placed on the market by
Arrow Machinists



Lathe work-driver introduced in this country by the Skinner Chuck Co.



Contour wheel dresser announced by Hogland Engineering & Mfg. Co., Inc.

Hoglund Universal Contour Wheel Dresser

A contour wheel dresser that can be used on any horizontal surface grinder for dressing wheels up to 3 inches wide and 20 inches in diameter has been announced by the Hoglund Engineering & Mfg. Co., Inc., 343 Snyder Ave., Berkeley Heights, N. J. Accuracy to 0.0001 inch and simplicity of operation are features of this KB11-3 dresser. It is lightweight, compact, well-bal-anced, and without interfering overhang. Magnetic-chuck mounting of the dresser is recommended for short runs, and permanent mounting for long runs. Because the dresser weighs only 50 pounds, it can be moved from one machine to another for dressing different forms by simply changing the template for each job. Any contour that the diamond can enter, no matter how complex, can be trued or dressed.

The dresser is manually operated, a minimum of skill being required by the operator to keep the stylus in contact with the template with his left hand, while the template slide is moved back and forth with his right hand. Movement of the diamond across the wheel duplicates to a reduced scale the movement of the stylus as it follows the enlarged scale template. This reduced scale movement is obtained by means of an inclined plane and slide arrangement. Vertical movement is reduced by a ratio arm. Thus the complicated linkages of conventional pantograph arrangements have been eliminated.

A microscope fixture eliminates guesswork in setting the diamonds. The reticle has four concentric rings with radii ranging from 0.005 to 0.025 inch, corresponding to the radii of the diamond tools. Diamonds can be set in their holders and then held ready for use without any machine "down" time. The slides operate on ball-bearing raceways

and all essential parts are hardened, ground, and lapped. Standard equipment includes one storage cabinet; one microscope diamond setting fixture; three styluses; three diamond holders; one roughing diamond; three finishing diamonds with radii and included angle to suit the work; three Allen wrenches; one stylus clamping screw; and one master setting gage. Two other models are available for 1- and 2-inch wide wheels.

Nebel Lathes Equipped with Power Rapid Traverse

A power rapid traverse attachment for lathes has been announced by the Nebel Machine Tool Co., Cincinnati 25, Ohio. This attachment which can be purchased as extra equipment for any of its engine, removable block gap, or extension bed gap type lathes, is designed to greatly reduce machining time and operator fatigue. An electrical interlock prevents engaging the feed or lead-screw while using the rapid traverse.

Combined lead-screw and control-rod hangers, shown at F, Fig. 1, are provided on long beds. These hangers are carried and released automatically at fixed positions along the bed. All controls of the rapid traverse attachment are located at the front of the lathe, thus eliminating the need for a

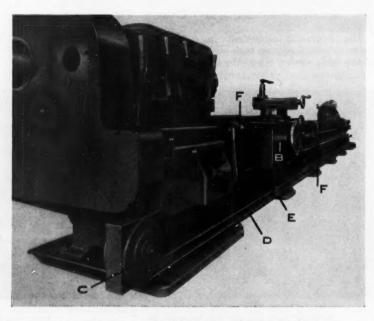


Fig. 1. Nebel lathe equipped with power rapid traverse attachment



The convenient centralized controls, the wide range of speeds and feeds, and the high visibility head of this Cincinnati Bickford Radial Drill are all contributing to fine performance on this job.

The Cleveland Pneumatic Tool Company say "Performance and ease of handling are all that could be desired."

On this cylinder for an aircraft nose type landing gear, drilling, reaming and spot facing operations are being done.

Cincinnati Super Service Radial Drills are accurate, powerful and profitable in the shop.

Write for Bulletin R-29.



RADIAL AND UPRIGHT DRILLING MACHINES

ICINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio, U.S.A.

MACHINERY, May, 1953-241

long traverse rod and complicated gearing.

Essential components of the attachment are the electric directional switch A, Fig. 2, located on

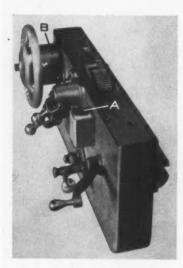


Fig. 2. View showing electric dilectional switch A and torque motor B of power rapid traverse attachment of Nebel lathe

Solid Race Type Ball Bearings

A line of precision-ground radial ball bearings designated the "C" series has been announced by the Nice Ball Bearing Co., Nicetown, Philadelphia, Pa. These bearings are of the solid race type with ball retainers and are made in inch dimensions which correspond to established light-duty inch standard sizes. They are designed for light-duty radial, thrust, or combined radial and thrust load applications at speeds in the neighborhood of 5000 R.P.M.



the apron for operator's convenience; and the torque motor B, geared to the rack pinion to provide the power for moving the heavy carriage longitudinally along the lathe bed. The electrical power line from the main drive motor control box is led to the reel C, then through channel D to junction box E, and thence to torque motor B on the apron.

Allen Improved Dial Feed Tables

Dial feed tables manufactured by the A. K. Allen Co., 57 Meserole Ave., Brooklyn 22, N.Y., are now available with a "positive lock" device. The device prevents the top plate from overriding the index position under the most severe operating conditions. This is achieved by the use of an auxiliary air cylinder built inside the table that brings into action a set of mechanical members which positively lock the feed-pawl to the ratchet.

When the table is in the indexed position an anti-back-up



Improved dial feed table announced by the A. K. Allen Co.

pawl locks it against backward rotary motion. A hydraulic check is offered as an accessory which provides a controllable shockabsorbing effect at the end of every index stroke. Two models-11FA and 11FB-are available with four, six, eight, twelve, or twenty-four indexing positions. Accuracy of indexing is guaranteed to plus or minus 0.002 inch measured at the periphery of the 11-inch top plate. Model 11FB is identical to Model 11FA except for the addition of a two-way valve and a pilot timer valve which make the table a fully automatic self-contained unit.

Mead Air Cylinders and Valves

Three air clamps, actuated by spring return type air cylinders, and two air valves, additions to the line of compressed air equipment manufactured by the Mead Specialties Co., Department CV-26, 4114 N. Knox Ave., Chicago 41, Ill. The air cylinders all have 3-inch bores and a power factor seven times the line pressure. They are made for operating strokes of 1, 2, and 3 inches. The two air valves seen at the bottom of the illustration have fittings for connecting 3/8-inch hose.



Dollinger Small Pipe Filter

One of four small pipe-line filters designed for installations requiring only 40 pounds per square inch maximum pressure for compressed air or gas, announced by the Dollinger Corporation, 11 Centre Park, Rochester 3, N. Y. The filters feature accessibility for quick inspection and cleaning. Available in four models and two sizes, employing either absorption pad media or the original Dollinger radial fin inserts. The smaller size filter has a diameter of 3 1/2 inches and a



ANNOUNCING 4 NEW CUTTING OILS!

2 DUAL-PURPOSE OILS (lubrication and cutting)

SUNICUT 11-S for medium duty on automatic screw machines
SUNICUT 209-S for heavy duty on automatic screw machines

2 SINGLE-PURPOSE OILS (cutting only)

SUNICUT 102-S for heavy duty on automatic screw machines
SUNICUT 110-S for heavy duty service in broaching, threading,
gear cutting, heading and similar applications

All four oils keep parts and tools cooler, help maintain closer work tolerances, permit longer runs between tool dressings. All are odorless and light in color. In addition, Sunicut 11-S and 209-S have high lubricating value and are nonstaining.

For your copies of the technical bulletins describing these new oils, call the nearest Sun office or write Sun Oil Company, Philadelphia 3, Pa., Dept. M-5.



SUN OIL COMPANY

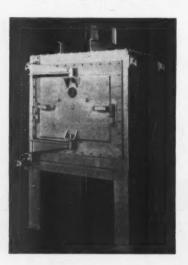


PHILADELPHIA 3, PA. + SUN OIL COMPANY LTD., TORONTO & MONTREAL

length of 61/2 inches. The larger size is 3 1/2 inches in diameter and has a length of 10 inches. The AA series of filters with absorption pad media remove the last traces of oil and water vapor from the lines, while the CH series with radial fin inserts are designed to rid lines of dirt and scale.

Westinghouse Draw Tempering Furnace

Electric box draw tempering furnace designed for applications requiring no protective atmosphere, now available from the Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa. This Type DB furnace is used for batch drawing or tempering high-volume work that can be handled on trays. The maximum operating temperature is 1400 degrees F. An automatic temperature control accurately regulates any set heat within this range. A high-velocity centrifugal fan provides uni-

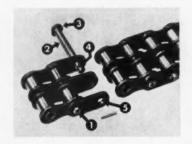


form air circulation over the heating elements and around the charge. Available in six sizes ranging from 15 by 24 by 12 inches to 42 by 72 by 30 inches. Five of the sizes utilize 480 volts while the smallest operates on 240 volts.

Baldwin Single-Pin Coupler Link for Roller Chain

Improved riveted roller chain being produced by Baldwin-Duckworth, Division of Chain Belt Co., Springfield 2, Mass. It is supplied in ASA standard and heavy series in 1-inch through 2 1/2-inch pitch sizes in multiple widths made up in 10-foot lengths of riveted chain, having a Baldwin-Rex single-pin coupler installed at convenient intervals. One end of the single-pin coupler link is firmly riveted to the

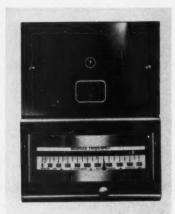
adjacent link (1). The other end contains the coupler pin (2). One end of this pin is spun over a washer (3). The other end has a milled flat and locking pin hole (4). This pin is an easy fit throughout the chain except for the milled flat end which is press-fitted into the special matching hole (5) of the single-pin coupler plate. Thus it is

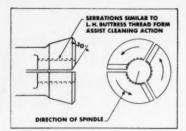


necessary to drive the pin only the length of its milled flat in assembling or disassembling the chain.

Bristol Electronic Pyrometer Controllers

Free-Vane electronic pyrometer controller of new line announced by the Bristol Co., Waterbury 20, Conn. This controller actuates relays, electric contactors, solenoid valves, and motor valves to provide close temperature control of a wide variety of furnaces, ovens, kilns, salt pots, plastic molding machines, and other heating equipment. It has a unique electronic control system based on the frequency modulation principle, a newly developed millivoltmeter mechanism, and unit plug-in construction. A model with an additional plug-in unit makes possible proportional current input to provide practically straight-line control of many heating appliances. A double control unit model is offered for lowopen-high or low-normal-high control.





Sheffer Self-Cleaning Collet

Self-cleaning collet introduced by Sheffer Collet Co., Traverse City, Mich. This collet is intended for use on automatics, turret lathes, and other machines where the collet is used in a rotating spindle. It is designed to prevent coolants and cutting oils, along with solids picked up by the solutions, from collecting in the collet slots and forming a sludge which will clog the collet and the chucking and feeding mechanisms. Also, sludge and oils are prevented from working their way in back of the work-piece and passing along the collet tube to the rear of the spindle.

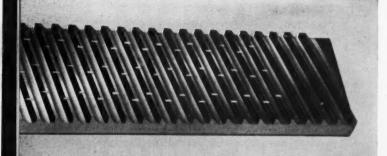


Benchmaster Universal Punch Press Guard

Barrier type punch press guard developed by the Benchmaster Mfg. Co., 1835 W. Rosecrans Ave., Gardena, Calif., to provide maximum operator safety regardless of the die used, without sacrificing press efficiency. By dropping numerous vertical rods (the number depending on size of bolster plate) through pre-located holes in horizontal guard retainer plates, a protective cage is set up around the die area. A guard of vir-

(Continued on page 250)

WHEN BROACHING... SAVE WITH CARBIDES







TOP: Carbide tipped sections of a Continental Surface Broach. Note the chip breaker grooves in the semi-finishing teeth and the solid finishing teeth.

MIDDLE: Carbide tipped finishing section of a Continental broach used on a cast iron application.

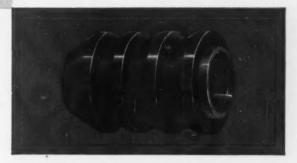
BOTTOM: Rough cast-iron parts made it necessary to use this carbide tipped broach to obtain satisfactory tool life in cutting half-round slots.



With Continental Carbide tipped broaches you'll get more pieces per grind, more pieces per broach, and more pieces per dollar. They are especially effective on cast iron parts.

Carbide tips may be used in all the broach teeth or in the finishing teeth only. Continental Tool Works Division of Ex-Cell-O has the technical knowledge to help you; Continental has been designing and building solid carbide and carbide tipped cutting tools since 1930.

For information regarding your application, or for a quotation on carbide tipped broaches, just give your local Ex-Cell-O representative the details or write to Continental in Detroit.



Solid carbide shell used on the finishing end of a High-Speed steel broach to hold size in cast iron parts.

53-16

TOOL WORKS DIVISION OF EX-CELL-O CORPORATION

LOOK.

no hands!

AUTOMATIC HANDLING plus CONTINUOUS BROACHING

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Detroit Flouch adds a new dimension in broaching economy. . . automatic handling of the work. By eliminating manual loading, production cellings are raised, costs are lowered and continuous efficiency is assured independent of the human element.

The application above—facing the ends and producing a flat on automotive king pins—illustrates typical benefits, Here, Detroit Breach applied a hopper and feed mechanism to a continuous breaching machine and thus eliminated manual loading of the parts. Precision tolerances are consistently held, production runs continuously and costs are at rock bottom. In this application the hopper is loaded manually, however, in many instances the hopper can be fed by conveyor from the previous operation.

On present or proposed broaching operations it will pay you to discuss automation with Detroit Broach engineers. Chances are these broaching specialists will be able to come up with recommendations that will result in considerable savings for you. If you will just drop us a line, the nearest Detroit Broach representative will give you all the details without obligation.

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Use the postage-free postcard below for further information on New Catalogues described in the May, 1953, issue of MACHINERY. Circle key number of item in which you are interested and print name and address on postcard.

NEW CATALOGUES

GEAR GRINDING MACHINE—Sheffield Corporation, Dayton 1, Ohio, Catalogue explaining the design features of the Model 140 reciprocating gear grinding machine. This Sheffield machine is Intended for the production of precision ground helical and spur gears used in such mechanisms as automotive transmissions, machine tool drives, and various timing devices. Can be obtained by writing direct to the above address on a business letterhead.

THREADING TOOLS—Murchey Division of the Sheffield Corporation, Dayton 1, Ohio, Catalogue presenting descriptions and specifications of threading tools—radial die heads, both rotating and non-rotating types, tangent die heads, solid adjustable taps, machine taps, pipe taps, and chasers. Can be obtained by writing to the address given on a business letterhead.

THREAD MILLING CUTTERS—Detroit Top & Tool Co., 8615 E. 8-Mile Road, Base line, Mich. Manual D-52, on thread milling and thread milling cutters, including technical data on speeds and feeds and correct cutter sharpening practices. Can be obtained when requested on a company letterhead direct to the above address.

HYDRAULIC CYLINDERS—S-P Mfg, Corporation, 12415 Euclid Ave., Cleveland 6, Ohio. Catalogue 103, descriptive of a new line of high pressure hydraulic cylinders, including a dimension drawing of each model. Can be obtained when requested on a company letterhead direct to the above address.

VERTICAL CHUCKING GRINDERS—Bullard Co., Bridgeport 2, Conn., Circular covering the new Bullard vertical chucking grinding machine for grinding the larger sizes of work. Can be obtained when requested on a company letterhead direct to the above address.

TAPS—Threadwell Tap & Die Co., Greenfield, Mass. Manual containing 55 pages of tapping dato, including latest Unified and American Screw Thread information. Among the subjects considered are tap and thread terminology, suggestions for tap sharpening, common tap problems, the standard system of marking, and lubricants. The material presented will be found helpful in the proper selection and use of taps.

BAKELITE POLYESTER RESINS—Bakelite Co., a Division of Union Carbide and Carbon Corporation, New York City, Booklet giving general information on production methods, formulations, and properties of polyester resins for reinforced plastics. Additional information is given on compounding, reinforcing materials, mold release agents, and fabrication of reinforced plastics.

STEEL HYDRAULIC YUBING—Summerill Tubing Co. Division, Columbia Steel & Shofting
Co., Pittaburgh, Pa. Booklet entitled "You
Can Make a Better Product with Steel Hydraulic Tubing," presenting the advantages
of steel saamless tubing and giving specific
data an common working pressures of available sizes of steel tubing.

OIL-HYDRAULIC PUMPS AND MOTORS— Waterbury Tool, Division of Vickers, Inc., Waterbury, Conn. Engineering data book describing the company's new line of heavyduty eil-hydraulic pumps and motors, suitable for extra large presses and machine tools, rotary machine drives, and other applications.

MAGNETIC CHUCKS—Sundstrond Machine
Tool Co., Rockford, III. Circular MC-2, entitled "Save Time by Eliminating Mechanical
Clamping on Production Machining with
Sundstrond Power-Grip Chucks. Ilustrations
show use of the chuck in heavy-duty milling,
production milling and grinding, and general
grinding aperations.

DRILL PRESSES—Walker-Turner Division, Kearney & Trecker Corporation, Plainfield, N. J. Bulletin on Walker-Turner machine tools for metal- and wood-working—light-heavyweight drill presses, rodial drills, jig and band sawe, spindle shapers, jointers, and lathes. Concles descriptions of the many models are presented.

STARTING SWITCHES — Allen-Bradley Co., Milwaukee, Wis. Bulletin 709, describing the many ways that the Allen-Bradley magnetic across-the-line starter can be applied. Illustrated are both wiring diagram symbols and line diagram symbols, and wiring systems for various starter applications.

ROLLER GEAR DRIVE—Roller Gear Division, Ferguson Machine & Tool Co., St. Louis, Mo. Bulletins 101, 102, and 103, on the Ferguson roller gear drive, explaining its characteristics and offering advice on selection of the proper gear drive for a particular installation. 9

CORROSION PROBLEMS—International Nickel Co., New York City, Reprint entitled "Water Side Deterloration of Diesel Engine Cylinder Liners," dealing with problems in water cooling of Diesel engines and outlining certain TAPS FOR UNIFIED THREADS—Prott & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Catalogue 17, listing styles and sizes of Pratt & Whitney high-speed steel commercial ground thread taps made to the new commercial ground high limit specifications.

RIVETED ROLLER CHAIN—Chain Beit Co., Baldwin-Duckworth Division, Springfield, Mass, Builetin 52-2, describing in detail the Improved Baldwin assembly riveted roller chainlow this chain is made up to any desired length is illustrated.

GEARS—International Nickel Co., Inc., New York City, Reprint entitled "Evaluating Surface Durability of Geors," describing a testing machine in its finally developed form, the test specimen, and the test procedure for determining the surface durability of geors. 14

CONTROL RELAYS — Westinghouse Electric Corporation, Pittsburgh, Pa. Booklet B-5817, presenting application and design information on the Westinghouse Type N control relay used, for example, to sequence multi-motor machine

MILLING AND CENTERING MACHINES—Motch & Merryweather Machinery Co., Cleve-iand, Ohio. Folder descriptive of the Motch & Merryweather three-station duplex type miling and center drilling machines. The operating cycle is gr

AUTOMATIC DUPLICATING MACHINES
Prott & Whitney Division Niles-Bement-Pond
Co., West Hartfard, Conn. Circular TL-19
M-1736 on P & W automatic duplicating ma-





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BUST COLLECTORS—Panghorn Corporation, Hagerstown, Md. Bulletin 915, explaining features of the Type CH-3 self-cleaning cloth screen dust collector, which uses the principle of reverse air flow for continuous cleaning of

CARBIDE BLANK AND TOOL PRODUCTS— Vascoloy-Ramet Corporation, Waukegan, III. Catalogue VR-441, covering in 56 pages the company's complete line of carbide blanks tools, and tool-holder inserts. Included is a section of technical data on carbide and its

NOTCHING UNITS—Weles-Strippit Corporation, North Tonawanda, N. Y. Catalogue N. illustrating and describing the complete line of Wales independent self-contained natching units for notching mild steel up to 1/4 inch

ABRASIVE PRODUCTS—Simonds Abrasive Co., Philadelphia, Po. Catalogue ESA-23, containing concise descriptions of the company's line of vitrified band abresive products, such as rubbing bricks, abrasive sticks, dresser sticks, and sharpening stones.

JIG BORER—Prott & Whitney Division Niles Bement-Pond Co., West Hartford, Conn. Bulletin descriptive of the P & W No. 2E Electrolimit lig borer for small to medium-sized jigs. A description of the Electrolimit method of

PRECISION LATNE—Clausing Division, Atlas Press Co., Kalemazoo, Mich. Catalogue C-2-A, descriptive of the Clausing I-Inch collet copacity laths. Construction features are explained, and accessories and specifications

PESK CALCULATOR—Pengborn Corporation, Hagarstown, Md. Folder consisting of a desk calculator presenting in easy-to-use form formulas, constants, and conversion factors useful in basic engineering, blast-cleaning, and dust control calculations.

MACHINING PACILITIES—Arthur Tickle Engineering Works, Inc., Brooklyn, N. Y. Booklet Cascribing and Illustrating the company's facilities for machining, forging, fabricating, spraying, casting, pipe assembling, and pater

GAGES—Prott & Whitney Division Niles-Bernent-Pond Cu., West Hortford, Conn., Data Sheet 2—Section 5400, on the Air-O-Limit blade gage designed to check the pitch diameter of the fir tree form on jet-engine compressor blades. 24

NEADER DIE NIBS—Carboloy Department of General Electric Ce., Detroit, Mich. Manua D-131, telling how to drill, assemble, and finish Series HN rough-cored header die nib employing the new grade 190 tungsten cor

HYDRAULIC HOSE—Champ Industries, Oivision of Hose Accessories Co., Philadelphia Pa. Leaflet outlining a simplified coupling procedure that makes use of the Champ hydroulic hose coupling shop, a complete unit to the coupling shop, a complete

VISE JAW PACEPLATES—Moroth Engineering Division, Kenimar Corporation, Glenville, Contact Leaflet descriptive of Newa-Mar vise jaw faceplates made in 1/4-inch sizes to fit any standard make of vise up to 6 inches. ... 29

DRILL PRESS VISES—Heinrich Tools, Inc., Racine, Wis. Cotalogue descriptive of Grip-Master screwless drill vises and fixture locks. Operation and maintenance instructions for the vise are given.

WELDING AIDS Arcae Corporation, Philadelphia, Pa. Booklet listing the technical information on welding practices in the form of bulletins, charts, and articles available from

AUTOMATIC PUMPING UNIT—Forval Corporation, Cleveland, Ohio. Bulletin 39, descriptive of the Farval DC-20 automatic pumping unit designed to provide dependable lubrication for single machines.

COUNTERBORES—Modern Corporation, Detroit, Mich. Catalogue supplying engineering and buying data on the company's complete line of standard counterbores, countersinks and care delils.

COMPARATORS—Magnetic Analysis Corporation, Long Island City, N. Y. Bulletin 30, describing a line of comparators for inspecting ferrous and non-ferrous materials or parts. 41

COMBINATION SHEAR, PUNCH, AND COPER—Kling Bros. Engineering Works, Chicago, Ill. Builetin describing various operations possible with the Kling shear, punch, and coper. 42

CHUCKS—E. Horton & Son Co., Windsor Locks, Conn. Folder on a new line of jet type chucks for jet-engine machining, designed to meet the increasing demond of the dircraft indus-

EXTRUSIONS—F. J. Stokes Machine Co., Philadelphia, Pa. Builetin 550, on the Stokes-Windsor twin-screw extruder for pipe, sectional extrusions, compounding, and color-

V-BELTS Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J. Catalogue listing fractional horsepower V-belts for use in servicing light-duty applications. 45

FASTENERS—Huck Mfg. Co., Detroit, Mich. Leaflet descriptive of the R-1018 Commercial Lockbolt for fastening wood to metal at production speeds.

PRODUCT DEVELOPMENT—Designers for Industry, Inc., Cleveland, Ohio. Folder explaining how this engineering concern can easist organizations in industrial product development.

WELDING HEADS—Sciaky Bros., Inc., Chicago, ill. Builetin 307-10, covering the Sciaky roteting upper stitch welding head which fits any electric resistance welder.

MOTOR PARTS—General Electric Co., Schenectady, N. Y. Booklet GET-2297, giving engineering data on series motor parts for built-in application.

WELDING TORCHES—Weldit, Inc., Detroit, Mich. Catalogue descriptive of the company's complete line of welding torches and cutting equipment.

VISES—Brown Engineering Co., Reading, Pa. Folder describing the Brown utility vise and its many applications to save set-up

INDUCTION MOTORS—Lima Electric Motor Co., Lima, Ohio. Bulletin giving engineering data on Lima Dripproof induction motors. Se

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In-line Valves

The reputation and performance of Ross In-line Series Valves are so outstanding that imitations are constantly being attempted. Through constant improvements, the Ross In-line Series remains the leader and the envy of the trade. Here's why-

- Dependable-10 to 20 million maintenance-free cycles, and many more tens of millions of life-cycles, are not uncommon.
- Speedy-split second operation; oversized exhaust.
- Low current consumption for solenoid models-inrush of 1.2 amps @ 110/60.
- Positive seal—poppet construction; Hycar
- Easy maintenance—only a few moving parts; can be disassembled without breaking line connections — solenoids readily accessible.
- Many modifications-vacuum, air, and liquid service; various pressures; available for AC or DC solenoids or air actuation with or without sequence timing; interchangeable heads.

Write for full information on the Ross In-line Series



110 E. GOLDEN GATE AVENUE

DETROIT 3, MICHIGAN

tually any shape can be formed by simply varying the height and position of the rods in the retaining plates. The rods are held at desired heights by means of small clips. To change the pattern for a new die requires only seconds. Openings in the guard can be arranged to permit parts to be inserted into the die. The guard is easily and quickly attached to all Benchmaster punch presses, as well as almost all other makes.



"Hyprez" Bench Stand for Diamond Compound Applicators

Bench rack designed to facilitate efficient use of "Hyprez" compound applicator guns manufactured by the Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. This stand, as shown in the illustration, will accommodate four applicator guns of any size and provide clearance for the special "Hyprez" reduction needle, grooves for lapping sticks, a hook for fluid atomizer, and adequate shelf space.

Pratt & Whitney Air-O-Limit Comparator

Air gage—called the "Air-O-Limit Model G" comparator—developed by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford 1, Conn. Features include high magnification, a new larger gage dial, and the use of long-wearing standard gaging plugs. Mag-



'nification is obtained by using a recently developed amplifying unit in conjunction with an adjustable restriction and a large indicating dial. The unit is furnished with either one of two magnifications, 10,000% (full scale equals 0.0008 inch, and each division equals 0.00010 inch) or 500% (full scale equals 0.0016 inch, and each division equals 0.000020 inch).



"Flexi-Speed" Drive

Variable-speed drive designed for flexible operation and application at low unit cost made by the Reeves Pulley Co., Columbus, Ind. This "Flexi-Speed" drive can be mounted in almost any position around the driven equipment. It can be used to drive in any direction, and will give any desired speed within a ratio of 8 to 1. The speed control handwheel can be located parallel to or in any of eight positions perpendicular to the motor shaft. Six different length belts offer a choice of shaft center distances. This drive is available in 1/2-, 3/4-, and 1-H.P. capacities for essentially all industrial applications.



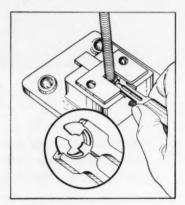
Groove Gage for Small Diameters

Gage for rapid, accurate measurement of small internal groove diameters brought out by the Rimat Tool Co., 21 W. Dayton St., Pasadena 2, Calif. This instrument is made in standard models small enough to enter a 0.310-inch bore and measure diameters for O-ring and snap-ring grooves. The measurement of thread reliefs, by-pass reliefs in hydraulic mechanisms, and small bores are among other uses.



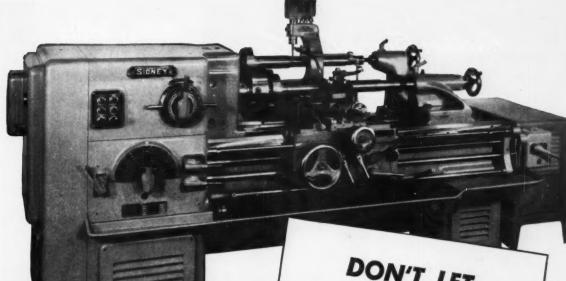
High-Speed Counterbores and Spot Facers

Short set aircraft style counterbore with 1/4-inch shank—one of a new line of counterbores and spot facers with interchangeable pilots recently added to the regular line of metalcutting tools manufactured by the **Butterfield Division of Union Twist Drill** Co., Derby Line, Vt. Four styles of high-speed standard counterbores and spot facers are now being manufactured. A long and short set is available in both straight and taper shank, as well as two additional styles that are made especially for the aircraft industry. The short set style with 1/4inch shank is designed for use with portable equipment such as hand drills. Ground pilots of alloy steel are manufactured in two styles, one for the standard counterbores and spot facers and the other for aircraft tools.



Dispenser Designed to Speed Up Assembly of Truare E-Rings

Dispenser brought out by Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y., to make possible faster assembling of Waldes Truarc E-retaining rings, Series 5133. The weighted dispenser base can be secured to the top of a bench or assembly table. These E-rings are supplied in sizes from 9 through 50 stacked on rods which fit into the base. The rod is locked into position and the rings line up ready for extraction, one at a time, with a Truarc applicator. As a ring is extracted, an actuating slide immediately feeds a new ring into position.



Old-fashioned, out-of-date and outworn equipment has no place in any modern industrial plant . . . and certainly plays havoc with your chances of competing successfully.

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OBSOLETE EQUIPMENT

PUT YOU OUT OF

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THE "LAST WORD" IN

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You save amazingly on productiontime per piece — in large or small quantities. You save on maintenance. Result: your costs are reduced so that you can compete . . . and GET THE ORDERS!

The sensitive tracer head transfers

every change in contour from the master piece or template to the cutting tool regardless of size, shape or quantity. Change-over to standard lathe operation or back to tracer requires only a few SECONDS since no addition or removal of extra parts is necessary.

WRITE FOR BULLETINS

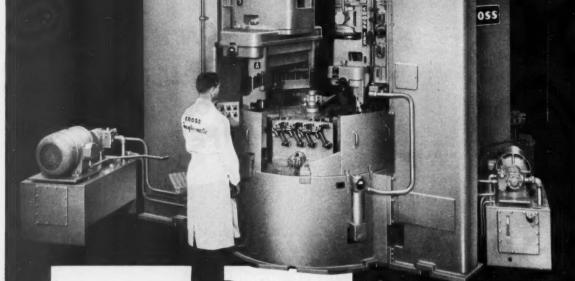
THE SIDNEY MACHINE TOOL CO. . SIDNEY, OHIO

Builders of Precision Machinery since 1904

Another Special by Cross

Mills, Drills 600 Connecting Rods Per Hour

CO.

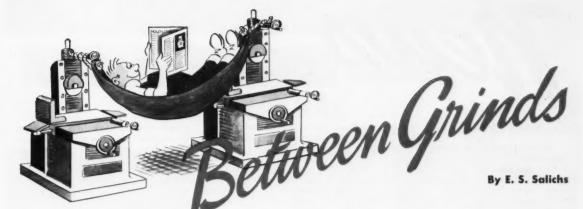


- ★ Drills stepped oil hole and mills lock slot of 600 connecting rods per hour at 100% efficiency.
- * Fluid motor driven index table.
- * Five stations—one for loading, one for milling and three for drilling.
- * Hydraulically operated work holding fixtures.
- * Pre-set cutting tools.
- Other features: Hydraulic feed and rapid traverse; hardened and ground ways, J.I.C. standard construction.

Established 1898

DETROIT 7. MICHIGAN

Special MACHINE TOOLS



Thirty Years of Misbehavior

A New Jersey town has long suffered from a flooded underpass during rains despite the fact that a pump had been installed thirty years ago to pump the water from a pit installed under the area back into the Raritan River, cause of the overflow. For thirty years, workmen have been turning the pump valve to the right and the result was always astonishing-more rather than less of the Raritan flooded the underpass. Now the borough engineer, intent on a modern drainage system at a cost of several hundred thousand dollars, made a discovery-the pump valve has a left-hand thread. By flicking the valve properly, the pump now functions as it should.

At Sixty Strokes per Minute, Too

Visitors to the Clearing Machine Corporation's plant during the 1953 Joint Industry Conference watched erection crews working on scaffolding surrounding a pair of hydraulic presses under construction. Then they

witnessed a 600-ton guillotine press being put through its paces. Thank goodness the scaffolding wasn't being readied for the latter press.

The Norton Story

The biography of a company has just reached us-the sixtyeight-year history of the Norton Co. written by a woman who interviewed over 300 active and retired employes to form the foundation of the book. Among the many illustrations of interest is the reproduction of the company's family tree which encircles the walls of Norton Hall. The roots of the tree are the founders; the trunk is formed by the factories; and the leaves are personified by the names of men and women who have been with the company for twenty-five years or more.

Definitely non-statistical in character, the book nonetheless contains such digestible facts as: "Sixty per cent of the employes live outside of a 5-mile radius, their average age is 47, and there is still a preponderance of Andersons and Johnsons in the

plant. The normal work week is 40 hours—in contrast to the 60 hours of 1900—and the average earnings are more than seven times those at the turn of the century. Working for each employe is seven times the mechanical energy that he had in 1900, and the average cost of his tools and equipment is estimated to be about \$7500." (The Norton Story: distributed by Commonwealth Press, 44 Portland St., Worcester 8, Mass. Price, \$3.75).

The Gravy Train

Then there was the release telling about a new mobile food train to be used for the in-plant feeding of industrial workers. The train, equipped to serve both hot and cold lunches, consists of a "tow truck, a cold-food car, and a hot-foot (?) car—all electrically operated." To discourage free riders/eaters?

Dig It

The slogan "Your Dirt Is Our Money" has been adopted by a Philadelphia company—an excavating company that is.

GOOD NEIGHBOR CONTRIBUTOR—Federico Strasser has been sending MACHINERY short articles from South America for a number of years (his latest on page 206 in this number). He was born in Budapest, Hungary, and after graduating from high school, went to Milan to study electrical engineering. He was employed there and later in Cologne, specializing in manufacturing methods of electrical wiring devices. In 1939, Mr. Strasser moved to Santiago de Chile, whore he has since become a parter in a progressive factory making electrical and plastic products, being in charge



of the development department and of the tool-room where dies, jigs, fixtures, and other special tools are designed and built. His work has led quite naturally to his hobby—energetically writing about machine shop practice. And that on an international scale, for his articles have appeared in trade journals in nine languages and been published in thirteen countries—latest count. In his middle forties, Mr. Strasser admits to feeling like a man of thirty, and it is possible that his home in Los Platanos is really the site of the Fountain of Youth.

MOUSTRY.

California and Oregon

WESTINGHOUSE ELECTRIC COR-PORATION, Pittsburgh Pa., has established an office at San Francisco, Calif. HAROLD G. RETHMEYER has been appointed branch manager with the following staff: sales su-pervisors—M. WAYNE SCOLARI, WAYNE GEORGE SKIPTON, G. BURNETT MA-SON, and DAVID F. ROACH; branch office supervisor, ALLAN S. JUDSON; engineering manager, DWIGHT R. HOOPES; and service manager, JOHN H. FOSTER. Mr. Rethmeyer, the new branch manager, was formerly manager of marine, aviation, and transportation sales in the Pacific Coast district. This vacancy will be filled by DAVID C. FULTON, who was formerly machinery electrification manager at Portland, Ore. He is succeeded there by CHARLES E. HAMMOND. EDWARD H. HULSE was appointed engineering and service supervisor at Salt Lake City, Minn., filling the vacancy created by the appointment of Mr. Hoopes to the San Francisco branch.

ROBERT D. WEBER, for several years chief engineer of Rosan, Inc. and Rosan Engineering Co., Newport Beach, Calif., has been promoted to the position of director of engineering for both companies. ARTHUR I. LUSK, assumes the position of chief engineer that became available with Mr. Weber's promotion. Mr. Lusk was formerly with

Northrop Aircraft Inc. Rosan, Inc., manufactures positive locking devices for threaded parts.

FRANK D. WALLACE has been made chief engineer of Magna Mill Products, South Gate, Calif., precision milling machine shop.

KARL GOETZ has been appointed manager of the San Francisco, Calif., branch of the Kurt Orban Co., New York City, distributor of German-made machine tools. The office is located at 3036 Telegraph Ave., Berkeley, Calif.

Power Wire Products Co. announces the removal of its Los Angeles plant to 1590 Monterey Pass Road, Monterey Park, Calif.

PRECISION CASTPARTS CORPORA-TION is a new concern established in the Pacific Northwest devoted to investment castings. The plant is located at 8705 S. E. 13th Ave., Portland 2, Ore. JOSEPH B. COX is president of the corporation.

Illinois

JOEL A. JANNENGA has been made chief engineer of Greenlee Bros. & Co., Rockford, Ill. Mr. Jannenga has been with the company since 1949. He succeeds JUDSON H. MANSFIELD, who has retired after forty-seven years of service. Mr. Mansfield

joined the company in 1905 as an apprentice patternmaker and became chief engineer of all divisions in 1918. He is being retained as an engineering consultant by Greenlee. DONALD E. HAWKINSON has been appointed sales manager of the special machine tool department. Mr. Hawkinson has been with the company for twenty-six years. In 1947, he became associated with the sales department, and for ten years prior to that was assistant chief engineer in charge of special machine tool design. Another announcement made by Greenlee was the appointment of E. C. VAN TIEM as manager of the Detroit, Mich., office. Mr. Van Tiem was a sales engineer in the Detroit office for seventeen years, the position he held at the time of his promotion.

WHEELCO INSTRUMENTS DIVISION, BARBER-COLMAN Co., Rockford, Ill., announces the following new addresses for the Division's branch offices, together with the men in charge: Baltimore—338 E. 25th St., Baltimore 18, Md., WILLIAM KARSLO; Chicago—2561 N. Clark St., Chicago 14, Ill., H. F. DAHLKE; New York—66 Hudson St., Hoboken, N. J., Herb Proske; Rockford—1300 Rock St., Rockford, Ill., VIC LATHERS; Springfield—1011 Ridgely Bldg., Springfield, Ill., KEN COATES; Boston—435 Newtonville Ave., Newtonville 60, Mass., E. W. HEFFER-

(Continued on page 259)







(Left) Joel A. Jannenga, new chief engineer for Greenlee Bros. & Co.; (Center) Judson H. Mansfield, retiring chief engineer; and (Right) Donald E. Hawkinson, sales manager of the special machine tool department



RAYDAC means Raytheon Digital Automatic Computer, developed by the Raytheon Manufacturing Company, Waltham, Mass., for the Navy's Bureau of Aeronautics. It is an "intelligence center" to help analyze the behavior of missiles during test flights. Its importance is indicated by the fact that in a matter of minutes it can perform the calculations involved in analyzing a single missile flight, a task that would take a team of mathematicians from 20 to 30 days. The Raydac thus speeds up tremendously the development and testing of such missiles. It contains enough tubes and germanium diodes made by Raytheon, for more than 1,000 home radio sets.

In such a complicated electronic computer reliability is essential. This is achieved through design, the choice of the best materials and components, and meticulous manufacture. Revere during the past 10 years has collaborated closely with Raytheon, working out proper specifications for materials, as for example, OFHC copper. Raytheon engineers and production men have visited Revere laboratories at New Bedford,

Mass., and Rome, N. Y., and many Revere specialists have studied methods and processes in the Raytheon plants and laboratories. These hand-in-glove contacts, many of them highly confidential, have proved their value.

The same kind of collaboration is open to you, and will be especially useful and time-saving if begun as soon as you have a new project on your boards. To obtain it, simply get in touch with the nearest Revere Sales Office. See your telephone book or write direct.

REVERE

Founded by Paul Revere in 1801 230 Park Avenue, New York 17, New York

Mills:Baltsmore,Md.;Chicago and Clinton, Ill.;Detroit, Mich.;Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

MADE TO STARRETT STANDARDS OF ACCURACY AND PERFORMANCE



Starrett
DIAL
INDICATORS

STARRETT DIAL COMPARATOR No. 653

With fine vertical adjustment. Base platen 9" x 9%". Vertical capacity 9%". Throat depth 5". Indicator graduated .001".



plete range of standard A.G.D.

sizes and 54 types, with English

GAGES

Made in a com-

or Metric graduations.

No. 1015-B

STARRETT PORTABLE DIAL HAND GAGES No. 1015-A and 1015-B

1/2" and 1" thickness capacities; 21/2" throat. Ideal for quickly measuring plywood, rub-

ber, textiles, paper, metal parts, leather, veneer, fabrics, etc.



STARRETT UNIVERAL DIAL BENCH GAGE No. 652

With sliding table and fine adjustment. Capacity 134", throat depth 154". Indicator graduated .0005".





WRITE FOR YOUR COPIES

DIAL INDICATOR CATALOG describes and illustrates the complete line with specifications and useful data... Address Department D. TRANSFER and DIMENSION CHARTS. Full scale details for quick tracing plus complete dimensions of all indicators and contact points.



Starrett

WORLD'S GREATEST TOOLMAKERS



THE L. S. STARRETT COMPANY Athol, Massachusetts, U. S. A.

MECHANICY HAND MEASURING TOOLS AND PERCISION INSTRUMENTS DIAL INDUCATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK HACKSAWS, BAND SAWS and BAND KNIVES THROUGH YOUR
INDUSTRIAL
DISTRIBUTOR
Prompt delivery

Prompt delivery
Dependable service
Quality products

VISIT BOOTH 42 . AMERICAN SOCIETY FOR QUALITY CONTROL . PHILADELPHIA . MAY 27-29

MACHINERY'S DATA SHEETS 729 and 730

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MACHINERY'S Data Sheet No. 730, May, 1953

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USEFU

Size

Drill

XX N

Compiled by Whitman & Barnes. Plymouth, Mich.

*Tolerances for drilled holes which can be maintained under

Style 17 Ex-Cell-O Precision Boring Machine equipped with new, inbuilt motor spindles for semifinish and finish-boring of wrist pin holes in automotive pistons.

Vibration-Free Boring

ON EX-CELL-O PRECISION BORING
MACHINE ASSURE FAST, ACCURATE
FINISHING OF PISTON PIN HOLES

The machine table feeds to the left for semifinish-boring, then to the right for finish-boring, assuring uniform stock removal for the finishing cut. New inbuilt-motor precision boring spindles are rigid and smooth running. Coolant is manifolded through the covers on both sides of the pistons.

IX-CILL-O for PRECISION

Wrist pin holes in automotive pistons are given exceptionally fine surface finish by this Style 17 Precision Boring Machine equipped with inbuilt-motor spindles. Diameters are held within .0003" total tolerance. The inbuilt motor positively eliminates any vibration that might originate in belts and pulleys.

The thin walled parts are held firmly, yet without distortion in a fixture which provides perfect alignment for bores through both bosses. Interchangeable locators are provided to accommodate two sizes of pistons. This machine both semifinishes and finishbores the pin holes. Production rate is high.

For further information on the many uses to be made of Ex-Cell-O Precision Boring Machines, see your local Ex-Cell-O representative or write today for Bulletin 31205.

EX-CELL-O

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS
CUTTING TOOLS * RAILROAD PINS AND BUSHINGS
DRILL JIG BUSHINGS * DAIRY EQUIPMENT
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS

NAN; Houston—1951 Richmond Ave., Houston 6, Tex., G. H. HAT-FIELD; Philadelphia—1433 W. Erie Ave., Philadelphia 40, Pa., J. W. HANCOCK; Rock Island—3714 14th Ave., Rock Island, Ill., H. C. REI-MERS; and Montreal—6693 Park Ave., Montreal 15, P. Q. Canada, GEORGE KNOWLER.

CHARLES J. LINDUSKA and How-ARD W. CARLISLE have been appointed assistants to the sales manager of the Clearing Machine Corporation, Chicago, Ill., press manufacturer. Mr. Linduska, with the concern since 1936, has been active in the sales department for the last ten years, and will now be responsible for the corporation's pricing policies. Mr. Carlisle was formerly representative in Ohio for Clearing, but for the last two years has been associated with N.P.A. as chief of the press and forging section. In his new position he will work with the field sales organization.

ROBERT G. MORGAN has been appointed to the post of district manager at Moline, Ill., for the Timken Roller Bearing Co., Canton, Ohio. Mr. Morgan was formerly district manager at the St. Thomas, Ontario, Canada, office, and this position will now be filled by ROBERT L. WILLIAMS.

WILLIAM W. JETTER and his father, J. WILLIAM JETTER, have joined the Mid-States Mfg. Co., Chicago, Ill., maker of arc welders, the former assuming the position of president of the company, and the latter, vice-president and general sales manager.

STAMCO, INC., New Bremen, Ohio, has appointed LUTHER & PEDERSEN, INC., 565 W. Washington Blvd., Chicago, Ill., representatives in the Chicago and Milwaukee territories for the Stamco line of slitting and shearing equipment.

PRATT & WHITNEY DIVISION NILES-BEMENT-POND Co., West Hartford, Conn., announces that its Chicago branch office has moved to larger quarters at 4649 W. Fullerton Ave., Chicago 39, Ill. C. G. CUNNINGHAM is district manager.

LEES-BRADNER Co., Cleveland, Ohio, announces the appointment of a sales representative to cover Iowa, Illinois, and Wisconsin; the CHARLES ROSS Co., Central National Bank Bldg., Rockford, Ill.

ROCKFORD SPRING Co., 1032 Mulberry St., Rockford, Ill., a firm recently organized to produce precision springs, is now in full production. JOHN E. WING, JR., is president and ROY H. FUERSTENAU, production manager.

S. L. CRAWSHAW has been elected president of AMGEARS, INC., Chi-

cago, Ill., and executive head of the company's Chicago operations. Mr. Crawshaw is this year serving as president of the American Gear Manufacturers Association.

LINDBERG STEEL TREATING Co., recently announced a \$2,000,000 expansion program which will include a 100,000-square foot plant at 1975 N. Ruby St., in Melrose Park, Ill.

INDUSTRIAL EQUIPMENT Co., Chicago, Ill., has changed its name to the INDUSTRIAL CRANE & HOIST CORPORATION. The concern manufactures overhead cranes, jib cranes, and monorail systems.

RAYBESTOS-MANHATTAN, INC., Passaic, N. J., has announced the removal of its Chicago, Ill., sales office from 445 Lake Shore Drive to 6010 Northwest Highway.

Indiana

STANLEY B. LINDH has joined the Atkins Saw Division of the Borg-Warner Corporation, Indianapolis, Ind., in the capacity of sales promotion manager. Mr. Lindh was an account executive with Hugh H. Graham Associates, New Britain, Conn., prior to this connection, and before that was assistant sales manager for the Morse Twist Drill & Machine Co., New Bedford, Mass. EUGENE A. PELIZZONI has been appointed works manager. Until recently, Mr. Pelizzoni was assistant works manager of the Mack Mfg. Corporation, Allentown, Pa.

HANNA ENGINEERING WORKS, Chicago, Ill., manufacturers of hydraulic and pneumatic cylinders and valves, has appointed the BARTON SALES Co., 1609 W. Third St., Fort Wayne, Ind., sales representative in northern Indiana, a territory previously serviced by the Chicago sales office.

RICHARD L. ROBERSON has been named assistant manager of the Indianapolis, Ind., branch of the Crucible Steel Company of America, New York City. Mr. Roberson joined the company in 1938, and has held the positions of office manager and sales service engineer.

Michigan

ALBERT J. McLAREN has been appointed to the post of sales manager of The Cross Company, Detroit, Mich., machine tool manufacturer. Mr. McLaren joined the engineering department in 1947, and was a sales engineer at the time of his appointment. WILLIAM PHILLIP GALLANT has joined the company, filling a newly created



Albert J. McLaren, who has been appointed sales manager of The Cross Company.

position, that of director of human relations. He will direct a comprehensive human relations program for the company.

JOSEPH L. GEENENS, formerly superintendent of the Alnico permanent magnet section of Carboloy's operations in Schenectady, N. Y., has been appointed manufacturing superintendent of the Edmore, Mich., plant of the Carboloy De-Edmore, partment of the General Electric Detroit, Mich. Mr. Geenens will be responsible for all manufacturing activities at the new plant, including carbide tool fabrication and Alnico permanent magnet production. He has been associated with the General Electric Co. since 1929.

FRANCIS J. SEHN has been appointed vice-president in charge of sales of the Sahlin Engineering Co., Birmingham, Mich., manufacturer of unloading devices. Mr. Sehn was formerly Detroit, Mich., district sales engineer for the Clearing Machine Corporation.

PIONEER PUMP DIVISION OF DETROIT HARVESTER Co., Detroit, Mich., has transferred its headquarters and sales offices to 2750 Guardian Bldg., in Detroit. The Division has also announced the transfer of its manufacturing operations to a new plant in Paris, Ky.

LEAKE ENGINEERING Co., Monroe, Mich., is a newly organized engineering company in the metal stamping field to be operated as an entirely separate unit from the LEAKE STAMPING Co. of that city.

MICHIGAN TOOL Co., Detroit, Mich., has acquired a building at 1119 E. Ten Mile Road, Hazel Park, Mich., to house production facilities of its new Shear-Speed Chemical Products Division.

C. O. HELPHENSTINE was recently appointed district manager of the Detroit, Mich., office for the British Industries Corporation, New York City.

Minnesota and Wisconsin

D. E. DALLMAN, assistant district manager, was recently promoted to the post of manager of the Minneapolis, Minn., district of AIR REDUCTION SALES Co., a Division of AIR REDUCTION Co. INC., New York City. Mr. Dallman replaces the late M. M. Weist who, until his death on March 6, had been connected with the company for thirty-five years.

E. F. Houghton & Co., Philadelphia, Pa., has formed a subsidiary company to be known as Houghton Vix-Syn Co., which will produce synthetic rubber packings. The plant is located in a new building at 140 Washington St., S., Hopkins, Minn. WILLIAM F. MACDONALD, president of E. F. Houghton & Co., is also president of the subsidiary.

Dow CHEMICAL Co., Midland, Mich., has opened a sales office in Minneapolis, Minn.

DEXTER FOLDER Co., Pearl River, N. Y., has acquired the supercharger business formerly owned and operated by the Pesco Division of Borg-Warner Corporation. The new activity will be known as the MIEHLE-DEXTER SUPERCHARGER DIVISION OF DEXTER FOLDER Co., and will be located in the plant of the Christensen Machine Co., subsidiary of Dexter Folder Co., Racine, Wis. HANS BOHUSLAV has been appointed general manager of the Division.

Welding Products Division Of The A. O. Smith Corporation, Milwaukee, Wis., has appointed three distributors for its welding electrodes and accessories and welding machines: Pensacola Welding Supply Co., Inc., 507 Palafox, Pensacola, Fla.; Worland Oxygen Co., Box 730, Worland, Wyo.; and Guilford Welding Supply Co., 1600 Guilford Ave., Baltimore 2, Md.

New England

GERRY T. ATTRIDGE, formerly general manager of the Lovejoy Tool Co., Springfield, Vt., was recently elected vice-president. Mr. Lovejoy has been with the company since 1946.

HARRY I. DIXON has become New England representative of the Alloy Precision Castings Co., Cleveland, Ohio, and has established an office at 1199 Beacon St., Brookline, Mass.

BRIDGEPORT BRASS Co., Bridgeport, Conn., is moving its New England warehouse facilities at Providence, R. I., to a new and larger location at 177 Georgia Ave. in Providence.

MAJOR LOUIS G. BURNS of Dayton, Ohio, has been appointed chief pump engineer of Chandler-Evans, Division of Niles-Bement-Pond Co., West Hartford, Conn. Major Burns is widely known through the aviation industry, having specialized in fuel systems and pumps for fifteen years.

JAMES E. DUFF, who has been advertising and sales promotion manager for the past year and a half at the Cuno Engineering Corporation, Meriden, Conn., has been appointed sales manager in the eastern district.

New York and New Jersey

G. A. GRAY Co., Cincinnati, Ohio, announces the appointment of the HARRINGTON WILSON BROWN Co., New York City, as representative for the company's line of planers, planer type milling machines and horizontal boring, drilling and milling machines. The representative will cover eastern New York, southern Connecticut, northern New Jersey, and northeastern Pennsylvania.

SAMUEL S. BOARD, JR., has been appointed director of research at the Buffalo, N. Y., plant of FARREL-BIRMINGHAM Co., INC., Ansonia,



Samuel S. Board, Jr., director of research at Buffalo plant of Farrel-Birmingham Co., Inc.

Conn. Mr. Board joined the company in 1938, and after working in various engineering capacities became plant planning engineer in 1945. Two years later he was transferred to the Buffalo plant as assistant director of research, the position he held at the time of his present promotion.

AMERICAN SCHIESS CORPORATION has been organized as an American affiliate of Schiess A. G., Dusseldorf, Germany, to provide technical assistance in industrial plants using Schiess equipment in the United States and Canada. The affiliate will be located at 205 E. 42nd St., New York City. An engineering staff is being established in Pittsburgh, Pa., with ROBERT C. ZEILE as manager.

HAMBURG MACHINERY Co. has been organized by AL HAMBURG, who has left the U. S. Machinery & Motor Co., which he founded. The Hamburg Machinery Co. will deal in new and used machine tools, parts, and accessories, and render a consulting service. The office will be located at 401 Broadway, New York City.

THORBJORN MADSEN has been elected vice-president in charge of production of the Scale Division by JOHN CHATILLON & SONS, New York City. Mr. Madsen has been with the company since 1927, and for the last four years has been works manager of the Scale Division.

AMERICAN SMELTING & REFINING Co., Barber, N. J., has appointed the Troy Belting & Supply Co., Inc., Troy, N. Y., distributor in eastern New York and western Vermont for the company's line of continuous-cast bronze products.

ARTHUR F. MOUL has acquired the sole ownership of Samuel C. Rogers & Co., Buffalo, N. Y., which manufactures knife and face grinders, and will now be president of the company. Mr. Moul was once a salesman for the company.

F. B. PINZEL has been appointed assistant general sales manager of the Buffalo Steel Division at Buffalo, N. Y., by the H. K. Porter Co., Inc., Tonawanda, N. Y.

NORTON Co., Worcester, Mass., announces that the New York City domestic sales office of the Abrasive Division, Grinding Machine Division, and Refractories Division, formerly located at 61 Broadway, has moved to Green and North St., Teterboro, N. J. The office of Norton Behr-Manning Overseas Inc., however, will remain at 61 Broadway.

ALBERT B. DISS has been appointed vice-president and general manager of the Watson-Stillman Co., Division of H. K. Porter Co., Inc., Roselle, N. J. Mr. Diss will be

DO Established 1888

CONTINUOUS-TOOTH HERRING B GEAR REDU

The Gear with the Backbone

Some of the Many Proven On-the-Job Advantages of This Type of Gear Reduction Are as Follows

- 1. No side thrusts.
- 2. No avoidable deflections, distortions.
- 3. No necessity for bearings having thrust capacity.
- 4. Stronger teeth, due to the arch-like construction.
- 5. Greater load-carrying capacity due to utilization of the full width of face.
- 6. More silent and smoother action due to absence of distortion.
- No impact stresses due to avoidance of sideways deflections.
- 8. Uniform load across face due to balanced thrusts of the opposing helices.
- 9. Better lubrication due to the oil film formed by "wedge action" of the teeth.
- 10. Less costly to produce due to the absence of side thrusts and no necessity for heavy sections to reduce deflections — also due to the simultaneous utilization of two cutting tools.

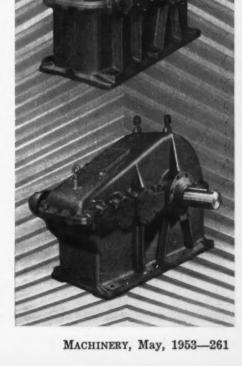
- 11. Can be substituted for straight tooth gears without any change in design of bearings or housings, or increase in face width, or alteration in pitch.
- 12. No axial float is necessary because the "V" shaped herringbone teeth wedge automatically into the mating gear thus eliminating all sideways motion and the consequent rubbing action of a screw-like nature existing in single helical gears which result in pitting and wear at relatively low loads.
- 13. Less expensive gear housings and bearing housings due to balanced thrusts.
- 14. Large helical angles are used; thus the full benefit of the helical principle is obtained.
- 15. Tooth deflection, though very small, results in the greatest load being carried by the strongest section.

All Gears are Generated Continuous-tooth Herringbone Gears, 20° pressure angle, 30° helix angle

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in complete charge of manufacturing and sales operations. At the time of his promotion, he was vicepresident in charge of manufacturing for Watson-Stillman.

L. RICHARD EDGCOMB has been made manager of non-ferrous sales for the Edgcomb Steel Corporation, Hillside, N. J., distributor of steel, aluminum and other materials. Until recently Mr. Edgcomb was in the Los Angeles, Calif., sales office of the Reynolds Metals Co.

WILLIAM J. HEALY, sales manager of the Turbine Division for the De-Laval Steam Turbine Co., Trenton, N. J., has been appointed also sales manager for the Blower and Compressor Division.

REYNOLDS METALS Co., Louisville, Ky., has announced the appointment of Mapes & Sprowl, Inc., 300 Burnet Ave., Union, N. J., as a distributor of Reynolds aluminum mill products.

TOPPER EQUIPMENT Co., manufacturer of Circo cleaning equipment, has moved to a new plant at Rahway, N. J.

Ohio

Myron S. Curtis, who for the last four and one-half years has served as director of engineering of the Warner & Swasey Co., Cleveland, Ohio, has been elected engineering vice-president. Mr. Curtis joined the company's engineering staff in 1940, and initially was largely responsible for developing the Warner & Swasey Sulzer weaving machine. He assumed the post of assistant director of engineering in 1945, and three years later became director of engineering and a member of the board of directors.



Myron S. Curtis, engineering vicepresident of Warner & Swasey Co.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, Cleveland, Ohio, has announced the following promotions: RICHARD R. SNOW, formerly general superintendent of the Division's Joilet, Ill., plant, has been named assistant to the vice-president of operations with headquarters in Cleveland, succeeding BURTON H. GEDGE, who is retiring after forty-two years of service; and John P. Debri has been made general superintendent at Joliet, succeeding Mr. Snow.

OSBORN MFG. Co., Cleveland, Ohio, recently announced three promotions in the Machine Division: GEORGE E. MILLER, who was assistant sales manager in the Division since 1945, assumes the responsibilities of sales manager; JAMES W. STUART, who was sales engineer in the eastern territory for the company, becomes assistant sales manager; and J. DOYLE ROBBINS, who was production manager of the Division, becomes assistant to the vice-president.

FIRTH STERLING, INC., Pittsburgh, Pa., tool and specialty steel producer, and A. MILNE & Co., New York City, solid and hollow tool steel distributor, have combined their warehouse service in the State of Ohio. Stocks will be distributed from A. Milne & Co. warehouses in Cleveland and Dayton, Ohio, and Pittsburgh, Pa. Firth Sterling business in other than retail tool steel will be handled as heretofore in Cleveland and Dayton branch offices.

Lodge & Shipley Co., Cincinnati, Ohio, builder of engine, tool-room, and T Lathes, has opened a new office building at 3055 Colerain Ave. Located in the modern three-story structure are the administrative personnel and the engineering, tool design, time study, and sales departments. The quarters formerly occupied by these groups have been release for much needed manufacturing space.

PARKER APPLIANCE Co., Cleveland, Ohio, has purchased the JIC line of hydraulic accessories for machine tools formerly made and in process of development by the Hydraulic Division of the Sundstrand Machine Tool Co., Rockford, Ill.

WILLIAM GOODRICH was recently promoted to the position of factory manager of the Die Supply Co., Cleveland, Ohio, while Louis O. Taber was named customer service manager, and Arthur Hazeldine, production control manager.

WALTER F. GREENWOOD has joined the Cleveland Welding Co., Cleveland, Ohio, subsidiary of the American Machine & Foundry Co., New York City, in the capacity of assistant to the president. ILLINOIS TOOL WORKS, Chicago, Ill., recently appointed the TRUMAN E. LONGLEY Co., Cleveland, Ohio, as northern Ohio distributor for Illinite metal-cutting tools.

MASTER CHEMICAL CORPORATION has moved to a new plant at 13 Huron St., Toledo, Ohio. The company manufactures Trim, a coolant for machine tools.

Pennsylvania

SALES & SERVICE MACHINERY Co., INC., 3818 Chestnut St., Philadelphia, Pa., is a new dealership in the Philadelphia area representing the following companies: R. K. LeBlond Machine Tool Co.; Elmes Engineering Division of American Steel Foundries, Inc.; Steelweld Division of Cleveland Crane & Engine Corporation; Peerless Machine Co,; Lucas Machine Division of New Britain Machine Co.; Fosdick Machine Tool Co.; Rockford Machine Tool Co.; Hartford Special Machine Co.; and Minster Machine Co. The company will also be distributor for Hammond Machinery Builders,

T. S. QUINN, treasurer and general manager of Lebanon Steel Foundry, Lebanon, Pa., will vacate the position of general manager which will be filled by his son, HARRY L. QUINN, secretary of the company, who will continue in this position as well. T. S. QUINN, JR., assistant plant manager, will become plant manager, will between plant manager, will fill the newly created position of chief engineer in charge of product. George D. KLICK has been named advertising manager. He was formerly assistant advertising manager.

STANDARD PRESSED STEEL Co., Jenkintown, Pa. has acquired the Sel-Lok spring pin, purchasing the production machinery inventory, and patents pending of the Self Lock Fastener Corporation from the Rafter Machine Co., Belleville, N.J. The equipment has been moved to Jenkintown. A division has been set up to manufacture and sell the product. JAMES F. REGAN, who was vice-president of the Self Lock Fastener Corporation, is general manager of the new division.

GEORGE M. GRAETZ has been named manager of the Lancaster, Pa., plant of the Welding Products Division of the A. O. Smith Corporation, Milwaukee, Wis. This eastern plant is under construction and will be completed by early summer. Mr. Graetz has most recently been acting as project manager in the development of the new plant for the manufacture of welding electrodes.

GEORGE C. Somes, Jr., has been named to the newly created position



of manager of sales promotion and merchandising for the Standard Pressed Steel Co., Jenkintown, Pa. Mr. Somes has been with the company for twenty years and, since 1944, manager of the New York City sales territory.

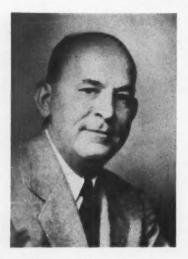
T. G. BARNES has been named general sales manager of Firth Sterling, Inc., Pittsburgh, Pa. Mr. Barnes was production manager at the time of his appointment, and this position will be filled by G. A. WILSON, who was formerly general superintendent of the Carbide Division.

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh, Pa., has appointed the following executives in the Switchgear Division: MAURICE H. HOBBS, assistant manager of the Division; CHARLES P. WEST, manager of engineering; and CHARLES E. BICKHAM, manager of order service.

YORK ENGINEERING & CONSTRUCTION Co. and YORK-GILLESPIE MFG. Co., of Pittsburgh, Pa. have combined their fabricating and machine shops, general offices, and engineering departments in one large plant, located at 39th St., and Allegheny Valley R.R. in Pittsburgh.

EDWARD H. BERRY has been promoted to the position of foundry manager and chief metallurgist of the Dodge Steel Co., Philadelphia, Pa., manufacturer of electric steel castings, while HENRY J. KELLY has been made chief engineer.

G. M. STICKELL, vice-president of the Landis Machine Co., Waynesboro, Pa., since 1942, while continuing to serve in that capacity, has also been appointed general manager. Mr. Stickell has been associated



G. M. Stickell, vice-president and now also general manager of the Landis Machine Co.

with the company since 1919. He succeeds J. H. ELLIOTT as general manager. Mr. Elliott, who formerly served as president and general manager, will continue as president of the company.

R. L. Wells has been appointed assistant manager of engineering, and P. G. Deriuff has been named manager of engine design for the Aviation Gas Turbine Division of the Westinghouse Electric Corporation, South Philadelphia, Pa.

GILBERT L. HOLT has been made works manager of the Berwick, Pa., plant of the American Car and Foundry Co., New York City. He was production manager at Berwick at the time of his promotion.

FOLLANSBEE STEEL CORPORATION has moved its general offices from the building it occupied for almost fifty years at Third and Liberty Aves., Pittsburgh, Pa., to 140 Stanwix St., in that city.

South Atlantic States

CLEARING MACHINE CORPORATION, Chicago, Ill., manufacturer of mechanical and hydraulic presses, recently appointed two sales representatives: HARRY P. LEU, INC., Orlando, Fla.; and SHOP SUPPLY Co., Birmingham, Ala., to represent Clearing in Alabama and Mississippi.

REID BROTHERS Co., INC., Beverly, Mass., recently appointed the LAFAYETTE TOOL & SUPPLY Co., 3355 N.W. 27th Ave., Miami 42, Fla., as dealer for Reid precision surface grinders. ALBERT SAMI is general manager of the Florida concern.

CLECO DIVISION OF THE REED ROLLER BIT Co., Houston, Tex., manufacturer of the Cleco and Dallett lines of air tools and accessories, has announced the appointment of the following distributors: F. C. BISHOP CO., INC., Box 21, Station H, Buffalo 14, N. Y.; FLOOD & CALVERT, INC., 2314 Strand, Galveston, Tex.; and PATERSON MACHINERY CO., 309 Seventh Ave., S., Nashville 4, Tenn.

BRIDGEPORT BRASS Co. is opening a new warehouse at 2209 S. Floyd St., Louisville, Ky. The building will also be headquarters for the Louisville district sales office.

Texas and Kentucky

BLACK & DECKER MFG. Co., Towson, Md., announces a \$2,000,000 addition to the branch plant located at Hampstead, Md. The additional space, which doubles the capacity of the existing plant, will be used for punch press, sheet metal, forging, field and stator winding, and large tool assembly operations.

ERNST W. FARLEY, JR., vicepresident and general manager of the Richmond Engineering Co., Richmond, Va., recently became president of the company upon the retirement of Thomas J. STARKE.

KURT OBRAN Co., INC., New York City, importer of metals and industrial equipment, announces the opening of an office at 1816 20th Street, Miami Beach, Fla. ARTHUR NICHOLS, who was formerly manager of the company's Boston office, will be in charge of the new office.

Coming Events

APRIL 27-MAY 8—BRITISH INDUSTRIES FAIR at Earls Court and Olympia, London, and Castle Bromwich, Birmingham, England. For further information, contact British Information Services, 30 Rockefeller Plaza, New York 20, N. Y.

MAY 18-19—First meeting of the NATIONAL FLUID POWER ASSOCIATION at the Bedford Springs Hotel, Bedford, Pa. Further information can be obtained from the temporary executive secretary, Barrett Rogers, 1618 Orrington Ave., Evanston, Ill.

MAY 18-20—Annual spring meeting of the METAL TREATING INSTITUTE at the Hotel Shamrock, Houston, Tex. For further information, write to the Institute, 271 North Ave., New Rochelle, N. Y.

MAY 18-22—FIFTH NATIONAL MATERIALS HANDLING EXPOSITION sponsored by the Materials Handling Institute, to be held at Convention Hall, Philadelphia, Pa. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

JUNE 1-3—Annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Holmstead, Hot Springs, Va. Executive Secretary, John C. Sears, Empire Bldg., Pittsburgh 22, Pa.

JUNE 16-19—National Spring Technical Meeting and Welding and Allied Industry Exposition of the AMERICAN WELDING SOCIETY at the Shamrock Hotel, Houston, Tex. Executive secretary, J. G. Magrath, 33 W. 39th St., New York 18, N. Y.

JUNE 28-JULY 2—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Statler, Los Angeles, Calif. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

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and what it can do for you . . .



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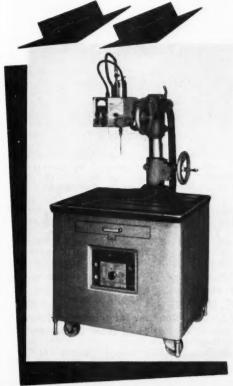
Cut oil holes in hardened gears without annealing



Cut dovetails in hardened dies



Cut any shape hole in cemented carbides



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Obituaries

BERTRAM H. LAWRENCE, retired vice-president—engineering, of the United, States Steel Corporation, New York City, died in his sleep at his home in Cleveland, Ohio, on March 25. Mr. Lawrence was born in Darlington, S. C., in 1882. He was graduated from Clemson College with a degree of electrical engineering. He became associated with United States Steel in 1904 as a hoisting engineer with American Bridge. Two years later, he became associated with American Steel & Wire as a draftsman at Waukegan, Ill. He subsequently held a number of engineering positions with the

organization in Chicago, Cleveland, Worcester, and Pittsburgh before being made chief engineer of American Steel & Wire in 1928. Prior to his retirement in 1948. Mr. Lawrence had been vice-president—engineering, of United States Steel of Delaware for ten years. He is survived by his wife.

JOHN M. MACRAE, for seventeen years manager of the Detroit, Mich., office of Greenlee Bros. & Co., Rockford, Ill., died on February 12 while on a visit to the home office. Mr. Macrae was born in the British West Indies and was graduated from McGill University. He had been associated with Greenlee for twenty years. He is survived by his wife and two daughters.

Interesting and useful supplementary information are contained in the manual's Introduction and Appendixes. The former discusses the virtues of screw thread unification and the history of how it came about. Among the handy tables given is one showing for each diameter what pitches of thread are available in the six series of standard threads.

ELECTRIC CONTROL SYSTEMS— Third Edition. By Richard W. Jones. 511 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, \$7.75.

This text is directed toward senior students who have had courses in alternating-current and direct-current machinery, ordinary differential equations, and elementary electronics. Analysis and graphical methods are used to develop basic ideas, and Boolean algebra is introduced to develop the fundamental aspects of relay-switching networks. Other features are the treatment of both the dynamo-electric and magnetic types of power amplifiers, and the fundamental concepts involved in the study of feedback controllers. Also included are problems that serve to bring out additional points not covered in the text and an extensive bibliography at the end of each chapter.

AMERICAN STANDARD MACHINE
TAPERS — SELF-HOLDING AND
STEEP TAPER SERIES (ASA B5.101953). 15 pages, 8 1/2 by 11
inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New
York 18, N. Y. Price, \$1.

AMERICAN STANDARD PLAIN WASH-ERS (ASA B27.2-1953). 5 pages, 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, \$1.

New Books and Publications

SIMPLIFIED DRAFTING PRACTICE. By William L. Healy and Arthur H. Rau. 156 pages, 8 1/2 by 11 inches; 221 illustrations. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, \$5.

This book is the product of the efforts of two executives of the General Electric Co. in simplifying drafting practice. As such, it marks a major departure from conventional drafting. The old concept of drafting, which permitted, and even demanded, meticulous and painstaking artistry, has been abandoned in this presentation.

By simplifying symbols and lettering techniques, by eliminating nonessentials, and by making extensive use of freehand drawing, the draftsman is shown how to increase his personal effectiveness, saving in time countless hours and in material much reproduction paper.

The chapter headings are as follows: Simplification; Eliminating Unnecessary Work; Freehand Drawing; Use of Symbols; Mechanical Aids; Abbreviations; Arrowless Dimensioning; Examples of Simplified Drafting; Legible Lettering; Tolerances; Use of Instructions; Drawing Forms and Related Routines; and Reproduction Processes. An appendix contrasts a number of conventional and simplified drawings.

MECHANICAL INSPECTION. By W. H. Armstrong. 361 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, \$5.50.

This book is intended to train inexperienced men and women as inspectors in machine shops and other related industries. Emphasis is placed on descriptions of tools used for dimensional inspection of machine shop products and on explanations of methods used by inspectors. Also considered are hardness testing, Magnaflux and radiographic inspection, and statistical quality control.

The mathematics required to perform different inspections is presented with the description of the particular inspection operation. Blueprint reading problems are included at the ends of chapters. Also, there is a bibliography of audiovisual aids for supplementary use. Designed primarily for class work, the text is nevertheless sufficiently detailed for self-instruction.

ASME SCREW THREAD MANUAL. Edited by Henry R. Cobleigh. 62 pages, 7 1/4 by 9 3/4 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, \$2.50 (paper-bound).

This publication, designed especially for shop and drafting-room use, has two main purposes:

1. To give the substance of everything in the American Unified Standards for Screw Threads and their Gages necessary in selecting, or designing and making, and testing the threads constituting the bulk of use. These are Coarse, Fine, and 8-Thread Series of standard threads of Classes 2A and 2B from the smallest to 1 1/2 inches in diameter. Tables of lints of size are confined to these threads.

2. To make possible calculation by simple arithmetic of all other standard threads and gages in the ASA Standards, and all special threads of the new A and B classes, except those of abnormal diameter, pitch, or length of engagement.

Summer Management Course at Iowa State University

The College of Engineering, State University of Iowa, announces that the fourteenth summer management course will be held June 15 through 27. The subjects to be covered will include production planning; job evaluation; motion and time study; wage incentives; plant lay-out; materials handling; quality control; supervisory training; labor relations and legislation; organization and policy; and public speaking. Further information can be obtained from Wayne Deegan, 113 Engineering Bldg., State University of Iowa, Iowa City, Iowa.





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The "world's smallest thread grinder", Sheffield's #133, requires floor space of only 30" x 50".

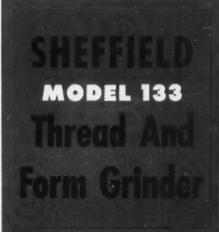
It is vital for low cost high production of small precise ground threads and intricate forms used in radar, guided missiles, telephone equipment and instruments of all types. It accurately grinds thread plug gages, taps and even micrometer spindle threads.

The multi-ribbed wheel dressed by the Sheffield Diamond Dresser assures high production and accuracy of form on threads of 12 to 120 pitch.

Accuracy of lead is controlled through the quick-change quadrant gear sector driven by the master lead screw.

Hollow live center workhead spindle permits work longer than the normal machine capacity and up to 1/4" in diameter, to be loaded without disturbing the tailstock setting. Change over from live to dead center spindles can be made in seconds. Operation is simple—one operator can handle two or four or more machines—and he need not be an experienced grinder.

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GAGES . MEASURING INSTRUMENTS . MACHINE TOOLS . CONTRACT SERVICES . THREADING TOOLS

Machine Tool Electrification Forum Held by Westinghouse at Pittsburgh

record attendance of 347 electrical engineers, machine tool builders, and editors of technical publications was attained at the seventeenth annual Machine Tool Electrification Forum, held on April 14 and 15. The Forum, sponsored by the Westinghouse Electric Corporation, was held this year at the Hotel William Penn. Pittsburgh, Pa. A variety of technical papers presented in the morning sessions dealt with electrical development of special concern to the machine tool industry. Panel discussions in the two afternoon sessions were devoted to expanding the contents of these papers. In addition, much constructive criticism was offered by those in attendance in regard to standardizing conflicting clauses in J.I.C., N.E.M.A., and N.M.T.B.A. electrical codes.

Papers Stress Machine Tool Automation

A paper presented by R. Juengel of the Ford Motor Co. showed how that company overcame many difficulties encountered in converting in-line transfer type machine tools from manual loading and unloading to fully automatic operation. Designing of such equipment as "through" machines rather than as "in-and-out" machines, and with more elaborate integration of switches and loading stop fingers, have been necessary for full automation. Mr. Juengel stressed the importance of having all mechanisms of an in-line machine remain stationary, without coasting or drifting, after the stop-button has been pushed.

William C. Gallmeyer, of the Gallmeyer & Livingston Co., explained how vibration mounts have permitted the use of standard electric motors on precision grinding machines. Heretofore, the only method of eliminating the wave pattern produced in the work surface by motor vibration was to build special motors having an oversized shaft and requiring an expensive dynamic balancing operation.

How automatic loaders speed the output of crankshaft lathes was brought out in a paper and a motion picture film presented by Nelson D. Cooper, of the R. K. LeBlond Machine Tool Co. Because of the construction of these lathes, the automatic loaders must follow a definite curved path, changing directions in both horizontal and vertical planes for loading. Another curved path is followed for unloading. This is accomplished by using mechanical motion, hydraulic power, and electrical control.

Switches Protect Units of Transfer Machines

Stanley I. Rice, Heald Machine Co., further elaborated upon the subject of automation, telling how it is being incorporated in the transfer type of machine tools produced by his company. He discussed the problems in switching and controlling that are involved in protecting certain units of a transfer type machine which are operative while other units are "down," or functioning improperly. For example, on some units it becomes necessary to use depthof-cut circuits on a drilling operation that is followed by a boring operation. If the drill does not complete its operation, a broken boring-bar is assured in the next station. To avoid this eventuality, a limit switch acts at the end of the drilling stroke to close a mechanical latching type relay, and another limit switch closes with the table in the retracted position. Only when the full depth of cut closes the latching relay, can a circuit be completed through the table-out switch to allow the transfer of parts.

The advancement of machine tool automation is being attained with certain telephone equipment, as was explained in a paper by H. E. Grimes, Avey Drilling Machine Co. A direct-drive switch used to select the proper ringing code or frequency on party lines was one of the devices cited. The company first used telephone equipment where conventional controls would have been impractical because of size and cost.

Kurt O. Tech, The Cross Company, read a paper on the coordination of electrical, hydraulic, and mechanical elements in machine tool design, in which he forecast that ever-increasing emphasis will be given to storage and memory devices as machine tool automation grows. He explained how proper liaison between the machine tool designer and the electrical engineer is essential in keeping controls simple

and accessible.

Addressing the Tuesday luncheon of the Forum, Tell Berna, general manager of the National Machine Tool Builders' Association, predicted an intensification of competition in our entire national economy. The answer to the top question among makers of civilian goods-"How can we get our costs down?"-will be placed squarely on the shoulders of the machine tool builder. If the manufacturers of the nation's civilian goods are to successfully meet the challenge of tomorrow, Mr. Berna claimed, obsolete machine tools must be replaced by models that do better and faster work.

Added features of the program were inspection tours to the Westinghouse Standard Control Division, Beaver, Pa., and the expanded generator and motor production facilities at East Pittsburgh, Pa. At the annual Forum banquet, T. Fort. Westinghouse Electric Corporation vice-president, defined the role of the "corporate citizen," emphasizing the close tie-up between good community relations and successful financial operations.

Gaillard Seminar

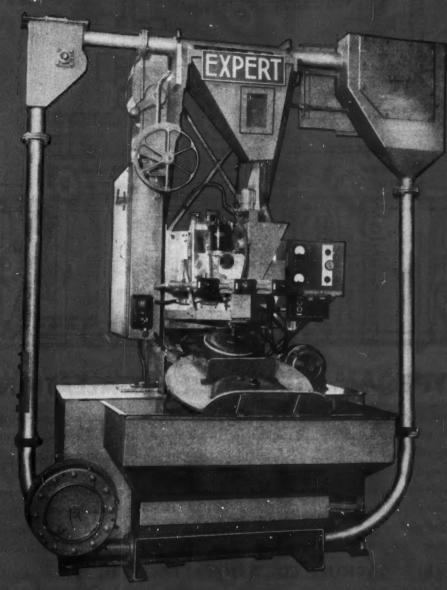
A five-day private seminar on industrial standardization will be led by Dr. John Gaillard from June 22 to 26 in the Engineering Societies Bldg., 29 W. 39th St., New York City. These seminars were started in 1947 upon request from companies for assistance in the organization of their standardization work and the training of their men in writing standard specifications. There will be ten conferences in all.

Further details can be obtained by writing to Dr. John Gaillard, 400 W. 118th St., New York 27.

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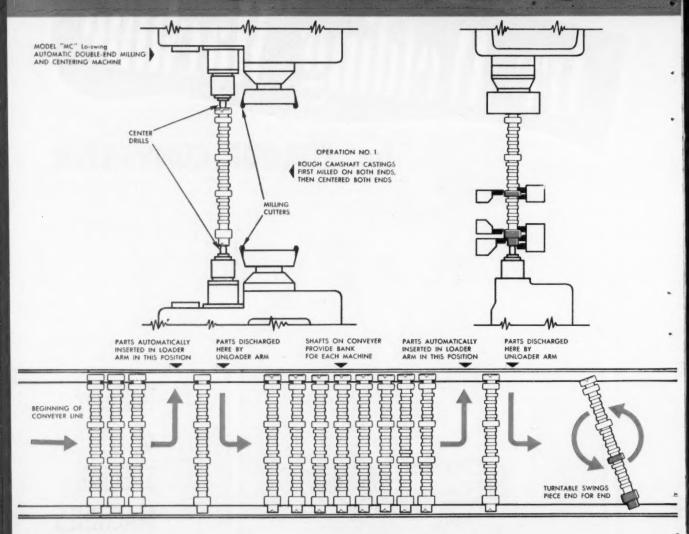
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The installation diagrammed above illustrates the New Lo-swing principle of Work Loading and Work Transfer which offers impressive economies by carrying automation far beyond the cyclic operation of individual machines. Rough work enters this system at the left and goes through three machining and two gauging operations automatically. Cycle time on individ-

ual operations varies without affecting smooth operation of the installation. Safety and Quality Control Devices instantly detect and signal offtolerance pieces.

The possibilities of this principle in the manufacture of repetitive parts are almost limitless ...the safety and economic advantages, tremendous. Your specific inquiries are invited.

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PRODUCTION COSTS

MODEL "LR" Lo-swing AUTOMATIC LATHE

OPERATION NO 2.

TURN THREE DIAMETERS, SQUARE AND CHAMFER AT ONE END OF CAMSHAFT

AUTOMATIC GAUGING STATION FOR OPERATION NO. 2.

STATION INDICATES OUT OF TOLERANCE PIECES BY COLORED LIGHTS, RETAINS SUCH PIECES AND STOPS LOADER ON PRECEDING MACHINE AUTOMATICALLY

SHAFTS ON CONVEYER PROVIDE BANK FOR EACH MACHINE

PARTS DISCHARGED

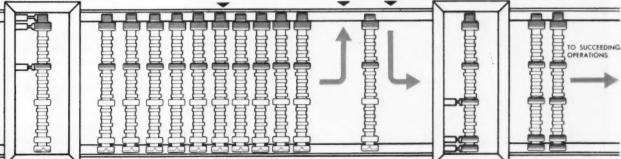
PARTS AUTOMATICALLY INSERTED IN LOADER HERE BY UNLOADER ARM MODEL "LR" Lo-swing AUTOMATIC LATHE

OPERATION NO. 3.

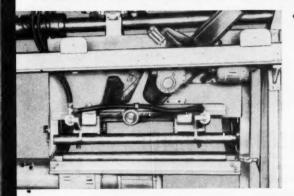
TURN THREE DIAMETERS, SQUARE AND CHAMFER AT OPPOSITE END OF CAMSHAFT

AUTOMATIC GAUGING STATION FOR OPERATION NO. 3.

STATION INDICATES OUT OF TOLERANCE PIECES BY COLORED LIGHTS, RETAINS SUCH PIECES AND STOPS LOADER ON PRECEDING MACHINE AUTOMATICALLY



CUTS OVERALL CAMSHAFT MACHINING COSTS



Seneca Falls Automatic Work Loader. Trolley at Work Transfer Station over Conveyor Line. Unloader Arm has discharged finished shaft. Loader Arm has picked up and is holding rough shaft.

Seneca Falls Automatic Work Loader. Trolley at Machine Station. Rough shaft just placed on centers. Unloader Arm holds finished shaft for delivery to Conveyor Line.



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Announcing NEW PINES



Patents Pending

SPECIFICATIONS

CAPACITY

Hydraulic Power - 20 tons.

Tube Size Range — ½" through 2" O.D. Maximum 2" x .083 steel tubing.

Bending Clearance — 2" tube with 5" center-line radius to 180°.

Twin double-acting cylinders off-set mounted on sides of press, direct connected to heavy, needle bearing crank arms of wing die holders. Three anchor positions compensate for various settings.

DIE HOLDERS

Forward-mounted, equally con-trolled wing-type with single screw adjustment and die recesses.

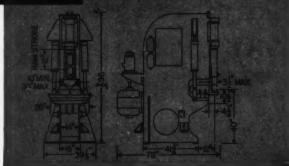
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Welded HR steel frame work, stress relieved. Incorporates oil reservoir, pump, motor, and valve-mounting units.

ELECTRICAL

20 hp, 1200 rpm motor powers 2000 psi Vickers pump. 220-440 volt, 3-phase, 60-cylce. Control circuits on 110 volt through transformer.

New Pines 20-Ton Vertical Hydraulic Tube and Pipe Bending Press showing side-mounted twin oil coolers, panel-mounted hydraulic valves, side offset-mounted cushion, and 10-station automatic angle-of-bend selec-tor turret. Note how design eliminating under die cushion mounting provides extra working clearance. On this setup, adjustable bars at left are used for posi-tioning workpiece for various planes of bends.



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Specialists in Tube Fabricating Machinery 686 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING . DEBURRING . CHAMFERING MACHINERY

20-Ton Tube and Pipe BENDING PRESS

DESIGNED WITH EXTRA WORKING CLEARANCE.... SPEEDS HANDLING BROAD RANGE OF MULTIPLE BENDS IN ONE SETUP

You'll find in the new Pines 20-Ton Hydraulic Press Bender a world of new production features, including those you have been wanting for a long time, that will help you substantially increase output and reduce production costs. You'll find the overall design affords greater working area on both sides and in front of the press and permits handling a much broader range of multiple bends in a single setup.

You'll like the new 10-station automatic angle-of-bend selector that eliminates cycling through idle stations, and the twin double-acting cushion cylinders on each side of the press that positively maintain a constant equalized pressure and help produce smoother, better bends without excessive flattening or distortion. Easy operating and setup features are included that save time and reduce operator fatigue.

These, and the many other outstanding Pines features listed below, will help you step up efficiency as much as 50% in handling, for example, automotive exhaust and tail pipes requiring a variety of bends in different planes, as well as the hundreds of other jobs adaptable to press benders.

OUTSTANDING FEATURES

- Twin Equalizing Side-Mounted Cushlons eliminate base obstructions, provide greater working clearance, maintain constant torque, reduce flattening and distortion.
- Fuster Cycling 10-station angle-of-bend selector indexes and resets automatically to starting position, eliminates cycling through idle stations, increases output.
- Greater Work Handling Capacity extra clearance reduces number of setups on multiple bending, permits broader use of uniform radii, cuts tooling and production costs.
- Interchangeable Pick-Off Turret for angle-of-bend control. Permits storing and remounting for repetitive jobs, reduces setup time, insures accurate duplication on repeat work.
- Adjustable Rum Speed Control assures efficient operation, simplifies setups. Ram can be lowered slowly or stopped at any point.
- Bullt-In Oil Coolers maintain uniform oil viscosity, assures uniform results on production runs.
- Single-Screw Wing Die Adjustment—eliminates problem of equalizing die settings. Adjusts both die holders simultaneously.
- Movable Foot Control assures maximum convenience, reduces operator fatigue. Master safety switch on ram slide.
- Sturdy Welded Steel Frame stress relieved, assures rigid die support, provides extra working clearance.
- Compactness Conservas Floor Space 100-gal. oil reservoir in base, motor vertically-mounted at rear, panel-mounted valves.



PROMPT DELIVERY — Write today for more data and prices on the new Pines High Production Bending Press. They are being lot-produced as standard units and prompt delivery can be made on early orders. They are designed and built by America's leading manufacturer of tube bending equipment.



Automatic Benders



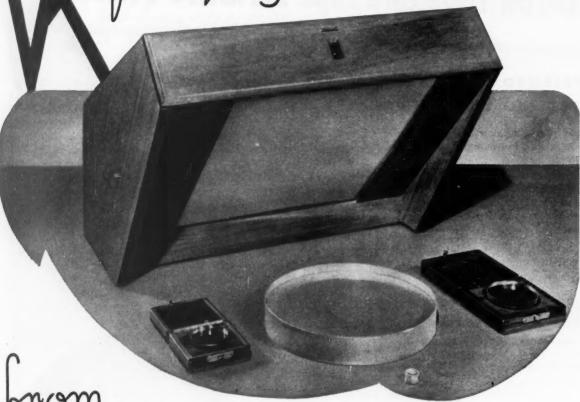


Tube and Rod End-Finishing Machines



Bench-Type End-Finishing Machines

used quartz OPTICAL FLATS



½" diameter up.... accurate to .000001

With VK Optical Flats, close checking of flat surfaces is simplified and more conveniently handled.

Shown here is the new Van Keuren monochromatic light, 11 221/4" wide, 171/4" high and 20" deep (in bench space). It is designed for use with large optical flats such as the one shown—a 10" diameter fused quartz double-surface master flat (accurate to .000001" both sides).

VK Optical Flats are available in sizes from 1/2" diameter to 10" diameter in .000001", .000002" or .000004" accuracy. They can be shipped within 30 days from order.

Catalog and Handbook No. 35 is available by writing: The Van Keuren Co., 178 Waltham St., Watertown, Mass. Ask for your copy.



178 WALTHAM STREET, WATERTOWN, MASS.
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires



The Bellows Air Motor is a complete air cylinder power
unit, with directional valve and speed controls built-in.

It requires only one air connection which can be made with
flexible hose
 The electrically-controlled Bellows Air

This different Air Cylinder Simplifies Designing

Motor takes less than half the space required for a conventional air cylinder set-up of equal power. Compact and complete, it fits well into cramped quarters or on moving machine elements • The built-in ELECTROAIRE VALVE* is solenoid-controlled, but air-powered. It's bullet fast, speeds up to 2200 movements per minute. But there's no pounding, no overheating. In fact, the solenoid control units are guaranteed against burnout. The low voltage used to operate the solenoid controls (8 volts) makes this unique air cylinder electrically safe for operators and machines. The low voltage simplifies wiring, permitting safe, positive) interlocked electrical circuits with a minimum of design difficulties. • Design with air in mind. With electrically controlled Bellows Air Motors you can eliminate cams, levers, gears, linkages or other mechanical means for performing push, pull or lift motions . . . saving designing time and production costs.

for pneumatic operation

This new 30-page booklet tells the complete story.

WRITE FOR IT TODAY

Address The Bellows Co. Dept. MA 553 Akron 9, Ohio Ask for Bulletin CL-30.

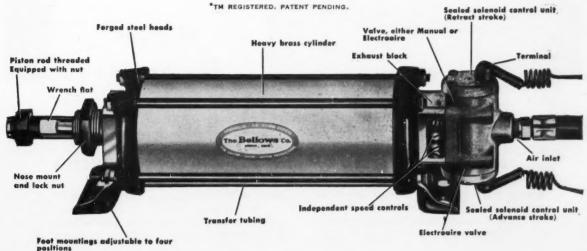
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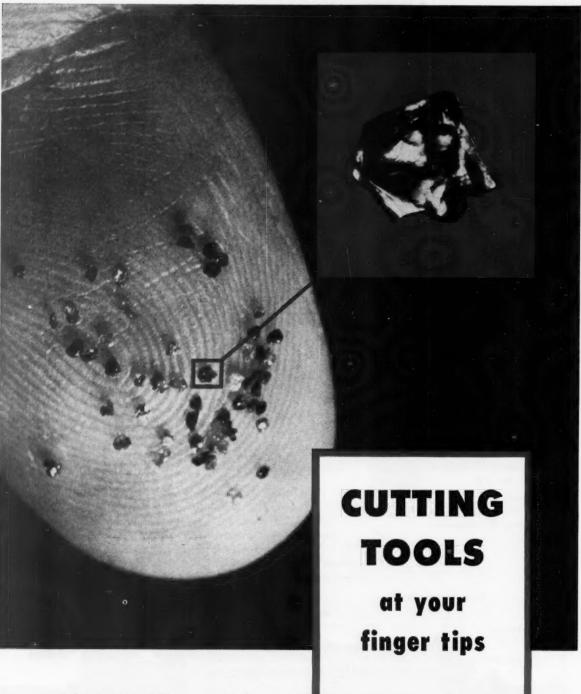


The Bellows Co.

AKRON 9, OHIO

The Bellows Air Motor illustrated is Model BEM5-25 (2½" bore, 2½" stroke). Other bore sizes are 1¼", 1¾", 2½", 3¾" and 4½". Any stroke length. Model shown is equipped with the ELECTROAIRE VALVE for full electrical control. Air motors with manually operated valves are also available.





The story of an entirely new

concept that led to CINCINNATI GRINDING WHEELS

This tiny grinding grit is the start of a completely new approach to grinding wheels. For years of research by Cincinnati Milling has proved, beyond doubt, that the grinding process is a true metal

cutting process. The grinding grits do not abrade or wear away the surface of a workpiece but form chips which agree in classification with the basic chip types found in other metal cutting processes. This new concept is not based on hasty conclusions. It represents 25 years of Cincinnati Milling research, coupled with practical experience in applying the basic fundamentals of grinding to a wide variety of work on both centerless and centertype machines.

Here is the starting point of development of the grinding wheel as a true cutting tool. And it is a development you might expect from Cincinnati Milling, with the world's largest background of research and experience in metal cutting operations.

For you, this means grinding wheels developed and tested over a period of several years on the basis of true function—as true cutting tools forming true chips.

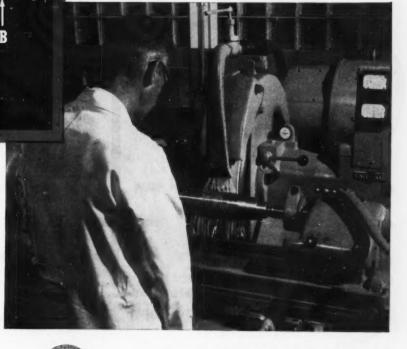
Available to you is a field organization of trained machinists who know grinding and grinding machines as well as grinding wheels. For a demonstration on your own machines of how to get the most out of Cincinnati Grinding Wheels, write, wire or phone Cincinnati Milling Products Division, The Cincinnati Milling Machine Co.

Ground surface of SAE 3145 steel showing partially formed chip (A) and groove (B) in workpiece from which material of chip was removed. Entire length of this chip is only about 0.002".

Performance of experimental wheel is checked by member of research staff on one of several grinders in the Cincinnati Grinding Wheels laboratory.

FREE BOOKLET

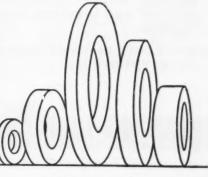
Now available to industry is a new booklet entitled "A New Concept In Grinding Wheels." It contains valuable information for everyone interested in grinding operations. And a copy is yours for the asking. Just write Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.



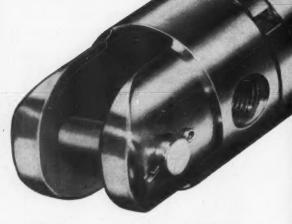


THE CINCINNATI MILLING MACHINE CO.

Cincinnati 9, Ohio



Spacemaker AIR CYLINDERS



- SAVES UP TO 40% SPACE WITH NEW STREAMLINED DESIGN.
- SUPER STRENGTH . . . EXTRA HIGH SAFETY FACTOR
- SOLID STEEL HEADS
- HEAVY WALL, PRECISION HONED, HARD CHROME PLATED, SEAMLESS STEEL BODY
- LEAKPROOF CYLINDER HEAD TO BODY CONSTRUCTION.
- RELATIVE PORT POSITIONS MAY BE ROTATED WITHOUT DISASSEMBLY OF CYLINDER AND LOCKED IN DESIRED POSITION.
- HEAVY DUTY, HI-TENSILE, HARD CHROME PLATED PISTON ROD.

CIRCULAR HEADS WITH TIE RODS

SQUARE HEADS WITH TIE RODS

SPACE
SAVED

T-J SPACEMAKER... provides additional room for adjacent equipment without sacrificing strength.

Streamlined construction of the new T-J Cylinders eliminates tie rods... reduces head size... and saves up to 40% in mounting space! In addition, a new high in strength is achieved with solid steel heads and heavy wall seamless steel body... leakproof construction... extra high safety factor.

Cylinder walls are precision honed and hard chrome plated for long-life efficiency. Available with the new T-J Super Cushion Flexible Seals which insure positive cushion with automatic valve action for fast return stroke. Many standard sizes and styles . . . both cushioned and non-cushioned . . . for wide range of pushing, pulling, lifting, clamping or control jobs. T-J dependability. Fast delivery to meet rush requirements. Write for bulletin 8152. The Tomkins-Johnson Co., Jackson, Mich.

37 YEARS EXPERIENCE

TOMKINS-JOHNSON

Many More Advanced Features!

MCCROSKY

COST CUTTING TOOLS

Specially Engineered

Multiple Operation

TOOLS



cut machining and set-up time, assuring close alignment of all surfaces, and unsurpassed uniformity and concentricity of finished pieces . . .

Individually engineered to the requirements of each particular job, McCrosky "Specials" combine related boring, facing, chamfering and reaming operations:— do them all at the same time with just one tool and one set-up. McCrosky "Specials" cut costs and practically eliminate spoilage and rejects. They pay their way on short or long production runs.

Use of McCrosky's Jack-Lock and Super-Jack Wedges and other shop-tested features give McCrosky "Specials" the strength and rigidity of solid tools yet permits the blades to be released and adjusted for regrinding easily and quickly,—saving time, minimizing the amount of blade stock ground away, and requiring fewer tools to keep a job running continuously.

Send for Bulletin No. 17-S. It illustrates more than 40 applications of McCrosky "Specials" and will suggest places where you too can use them to turn out better products, quicker and cheaper!

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Universal

MILLING CUTTERS

Body can be bladed to rotate either right or left hand. Consequently, select-

ing blades with tips of proper material mounted at proper angles produces a cutter that meets any metal or machine condition. Write for Bulletin No. 531 today.

MCCROSKY

Super Adjustable
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Complete line includes chucking reamers with straight or topered shanks, shell reamers with tapered holes for standard arbors or large straight holes for line bar reaming. Stock sizes from 15/16" to 6" diameter. High speed, cast alloy or carbide tipped blades. Write for Bulletin 18-R.

MCCROSKY

Jack-Lock® MILLING CUTTERS

Face Mills, Shank and Shell End Mills, Half Side and Staggered Tooth Milling Cutters fitted with high speed steel, cast alloy or carbide

steel, cast alloy or carbide tipped blades. Sizes from 3" to 24" in diameter to meet any requirement. Write for Bulletin No. 17-M.

MCCROSKY

Block Type

BORING BARS

Individually ground and hardened tapered V-key center the block and cutting blades accurately and rigidly yet permits easy release for regrinding, and "floating" with extreme accuracy when making finishing cuts. Wide range of stock sizes. Write for Bul. 17-8.

MCCROSKY

Wizard®

QUICK-CHANGE CHUCKS

McCrosky's Wizard Quick-Change Chuck and Collet outfits hold tools centered and rigid. They enable the operator to change tools easily and quickly, without stopping or slowing down the spindle. Successive operation jobs become continuous. Write for Bulletin 18-C.

MCCROSKY

Turret

TOOL POSTS

These tool posts permit successive tools to be swung into cutting position quickly, indexed accurately, and locked rigidly, giv

rately, and locked rigidly, giving engine lathes many of the advantages of turret lathes. Four styles—11 sizes. Write for Bulletin 17-T.





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Engineering and Sales Representatives in the Principal Cities

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3 OUTSTANDING Advantages of

SPRINGFIELD VERTICAL GRINDERS

ALL SLIDEWAYS ABOVE GRINDING WHEEL

protected from abrasive dust and grit ... LONGER LIFE.

NO GRAVITATIONAL PULL

to throw work out of line.

Work sets solidly on vertical spindle... GREATER ACCURACY.

EASE OF OPERATION

All controls conveniently located at normal height; greater work visibility; easier loading

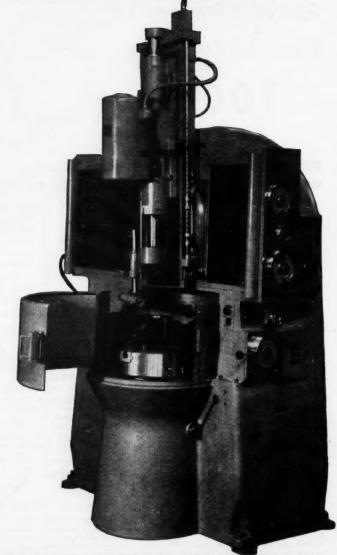
... HIGHER PRODUCTION.

PLUS the added advantage of GREATER VERSATILITY

Grind combinations of O.D., I.D., faces, tapers, shoulders or steps with one set-up. Hold extremely close related tolerances.

Springfield Vertical Grinders are thoroughly proved by 14 years of time-saving, cost-saving precision production. Various capacities to 42" swing x 24" hole depth.

Write for Catalog 183



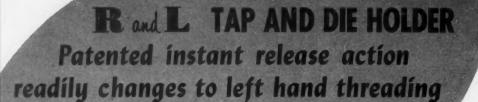
THE SPRINGFIELD MACHINE TOOL COMPANY

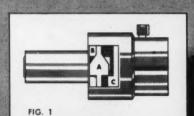
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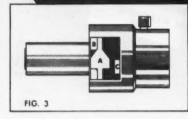


Fig. 2. The clutch instantly engaged to full contact between A and C at moment tap or die engages work.

Fig. 1. The clutch slightly engaged at C at start of threading operation.

Fig. 3. Fully released, there is ample clearance between clutch's contact points.

Note: A shorter clutch ring retaining nut can be substituted for operation on extra short threads.

Unite for complete catalog



1825 RRISTOL STREET . PHILADELPHIA 40. PA.

TURNING TOOL - TAP AND DIE HOLDER - UNIVERSAL TOOL POST - TURRET BACKREST HOLDER - CUT-OFF BLADE HOLDER - RECESSING TOOL RELEASING ACORN DIE HOLDER - REVOLVING STOCK STOP - FLOATING DRILL HOLDER - KNURLING TOOL - CARBIDE AND ROLLER BACKRESTS

FEED AND SPEED CHANGE -LIGHTNING-QUICK!





Part—Clamp Post; Material—X-1315 Steel: Preselected Spindle Speeds— 5; Cuts required—10; Time per piece—40 seconds; Setup Time—35 minutes.

SPEEDI-MATIC FEATURES

- Automatic electronic speed change, preselected for as many as nine stations.
- Automatic electronic feed change, preselected for as many as six stations.
- Infinitely variable range of spindle speeds—40 to 4000 rpm.
- Feeds from 1/4" to 16" per minute.
- Quick-acting, spring-return, hand-operated cut-off slide.
- Air-fed pusher-type collet attachment.
- Collet chuck capacity-%".

PRESELECT Any 9 Spindle Speeds...40-4000 rpm AND PRODUCE!

For peak screw machine production, take a good look at the Monarch Speedi-Matic. This electronically-controlled lathe, with instant preselected speed and feed changes in a wide stepless range, saves as much as 50% on production times. Add its average 45 minute setup time—without feed cams, and you see why it has proved unbeatable in runs of 25 to 2000 or more pieces.

The preselected speed and feed settings can be made for all six turret stations; the preselected speed settings for cross feed slide operations. Being wide in range and infinitely variable, they provide better finishes and closer tolerances—toolroom accuracy at production line speeds.

The Speedi-Matic, to repeat, stands for speed—with Monarch standards. It has won a name in metal-working circles as "The world's fastest hand screw machine." And we've got performance records and job data to back up that name—all neatly presented, with specifications and complete information, in our illustrated Booklet No. 1903. For this booklet—or information on other Monarch turning equipment—simply write us on your letterhead . . . The Monarch Machine Tool Co., Sidney, Ohio.





Exploded view showing Beaver's simple, positive, blade locking system.



The quality and fine workmanship of Beaver Milling Cutters are not the only reasons for their popularity. The Beaver system of fast, accurate, cutting-blade maintenance is a time and money-saver worth considering.

Beaver's simple, accurate blade-grinding fixture enables you to grind blades individually and uniformly on your own surface grinder. Beaver's system permits accurate sharpening for shortoverhang set-up which means less breakage, longer blade life and less down-time for repair.

Individual sharpening means less blade loss per sharpening and more complete use of each blade. Extra sets of sharpened blades can be kept on hand for emergency use. With Beaver's, specially designed, blade-setting fixture you can easily install new blades quickly and accurately. The entire Beaver operation of removal, sharpen and reset cuts "in assembly" sharpening time in half.

See our Catalog 52 for cost reducing Beaver Tools



Seaver Blade-grinding fixture.

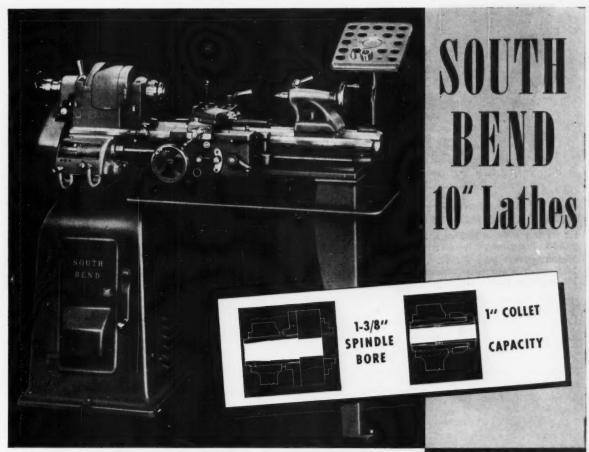


Seaver Blade-setting fixture.

AVER TOOL AND ENGINEERING

2850 ROCHESTER ROAD • BOX 429, ROYAL OAK, MICH., Teletype - Big Beaver 648





10" Precision TOOLROOM LATHE

Sound design, expert workmanship and quality materials give the 10" South Bend Lathe the dependable performance you want. Equipped with a precision lead screw, thread dial indicator and thread cutting stop, you can use it with confidence for cutting screw threads, making precision gauges or turning out instrument parts.

Another outstanding feature is the 1" collet capacity and 1-3/8" spindle bore which is built on the same design and specifications of larger lathes. The large spindle bore gives you big lathe collet capacity in a small, compact unit.

You will like the way this lathe cuts idle time . . . reduces costs . . . releases big lathes for heavy work. Write for catalog today.

SPECIFICATIONS

SWING 101/8" over bed and saddle wings, 534" over cross

SPINDLE SPEEDS (12) 50 to 1357 r.p.m., approximately. POWER LONGITUDINAL FEEDS 48 R.H. or L.H. 0015"

to .0836"
POWER CROSS-FEEDS 48 . . .

.0006" to .0309"
THREAD CUTTING 48 R.H. or
L.H. pitches, 4 to 224 per inch.
MODELS Quick Change Gear
and Toolroom, bench and floor
type.

SEND INFORMATION CHECKED:					
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Building Better Tools	Since 1906 . S	OUTH BEND	LATHE . Sout	h Bend 22, Inc	liana



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for the inspection of internal and external lengths and diameters, profiles, threads, etc.

Measuring	range	10"
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Maximum	length of threaded parts admitted	16"

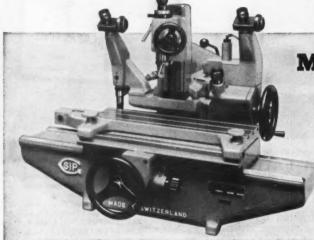


MU-214 B THREE-COORDINATE UNIVERSAL MEASURING APPARATUS

for the inspection of all kinds of gauges, tools, components, internal and external threads, racks, etc.

Measuring range	16"×4"×6"
Dimensions of cost iron table	191/4"×51/2"
Dimensions of glass table	161/2"×41/4"
Rotary table for measurements in polar dividing head, goniometric microscope croscopes for various purposes, etc.	

A most versatile measuring apparatus



for most accurate measurements (lengths, diameters, threads, tapers, etc.).

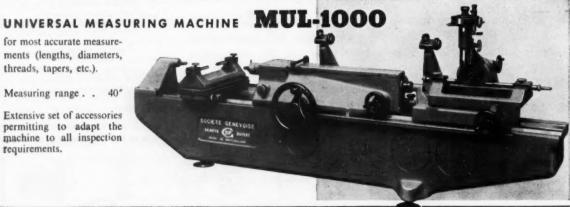
Measuring range . . 40"

Extensive set of accessories permitting to adapt the machine to all inspection requirements.

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The tireless muscles of compressed air lighten labor all along the production line.

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On power presses, press brakes, and any machine using either a friction or mechanical clutch, Schrader Machine Controls promote building a high-speed work rhythm that pays big production dividends with safety. Operators cannot tie down one of the two hand controls, since both hands must operate the valves at the same time or the press will not function.

These are only two of the many hundreds of new and improved Schrader Air Control Products that build production and safety in your plant. It's easy to get complete details. Write, outlining your present or projected use of power machinery—or fill out the coupon below.

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Gone . . . costly thorns in their side

But removal by muscle methods is aggravating because it is costly, inefficient and non-uniform in quality. Here's how a truck manufacturer has banished these "thorns in the side" with push-button brushing.

The operation: to deburr, break and blend the flank edges of gear teeth prior to shaving and heat treating. Formerly done with a hand tool, in several operations, the work was tedious and required close inspection and reworking to meet rigid specifications.

Now, an Osborn Brushing Machine in one speedy operation smooths the entire tooth edge . . . produces uniform blending of surface junctures of every tooth. Result: lower costs and greater precision for better performance of the product in service.

Find out how you can cut your costs and improve your products with power brushing. Call the nearby Osborn Brushing Analyst or write The Osborn Manufacturing Company, Dept. D-5, 5401 Hamilton Avenue, Cleveland 14, Ohio.

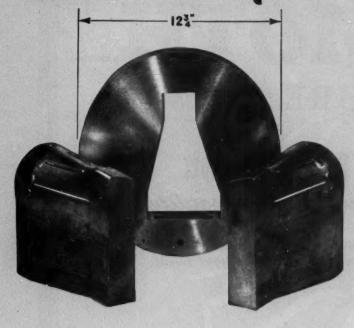




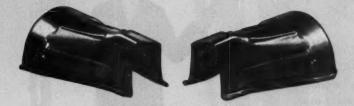
AFTER deburring with Osborn Brushing Machine.

OSBORN POWER, MAINTENANCE AND PAINT BRUSHES AND FOUNDRY MOLDING MACHINES

Just this tooling ...



makes 2 drawn parts...



by Hydroforming

What would it cost you to tool this job?

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U.S.A.

HYDROFORM TOOLS ARE CHEAPER TO MAKE

The parts illustrated below are right-hand and left-hand sections of a stainless steel duct—a jet-engine component. The one draw ring shown was used to Hydroform both parts, by simply turning it upside down to draw the opposite section. The punches were made of cast iron, machined to shape.

Liberal clearance is permitted between the punch and draw ring—up to 50% of the thickness of the material being drawn. Punches can be made of inexpensive, easy-to-work materials—mild steel, brass, Kirksite, plastics—depending upon the material and shape of the part.

GET BETTER PARTS... BIGGER SAVINGS... BY HYDROFORMING

You'll save on tool costs, certainly, by Hydroforming—and produce parts of higher quality, in fewer operations as well. Bulletin M-1759-1 gives detailed information on this simplified deep drawing process. Write for your copy. For data pertinent to your production, call in a Cincinnati Milling field engineer.



Hydroform

MAMMOTH

or MINIATURE

The LONG and SHORT of Measuring Versatility

From four inches to fifteen feet, there's an ETALON Instrument to meet your needs!



Manufactured of specially selected STAINLESS STEELS — HARDENED and NORMALIZED — ETALON CALIPERS are helping to maintain standards of accuracy in shops the world-over.

Whenever you require accurate and dependable calipers, micrometers, height gauges, indicators or other precision measuring instruments — follow America's leading manufacturing plants — SPECIFY ETALON TO BE SURE OF THE FINEST!

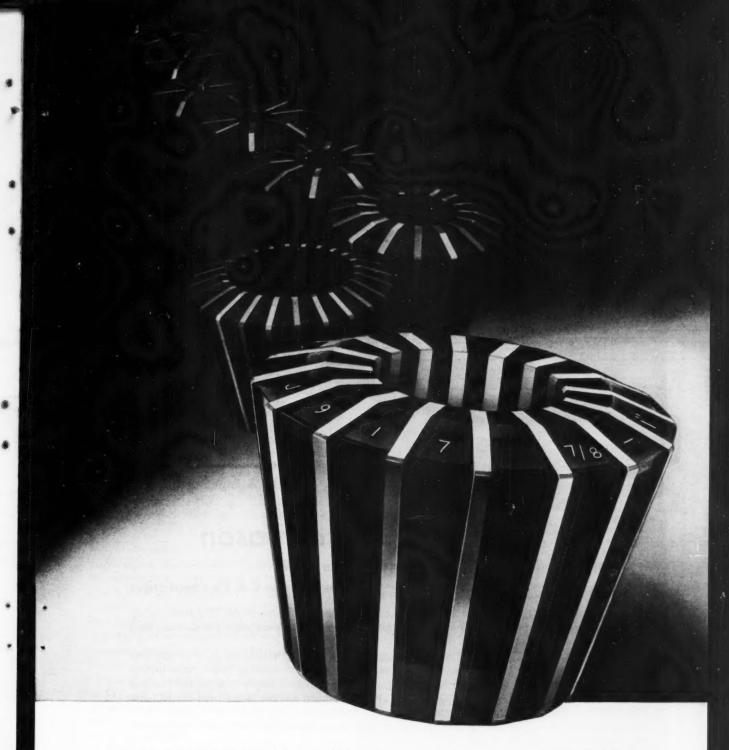






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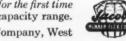


UNPARALLELED GRIP from parallel jaws

Latest And Greatest In Collet Design! Tool engineers and machine tool builders praise the Jacobs Rubber-Flex Collet as one of the outstanding developments in modern tool history. This new principle of collet construction brings you not only great improvements in gripping power, ac-

great improvements in gripping power, accuracy, and service life, but — for the first time — a collet with a full ½ inch capacity range.

The Jacobs Manufacturing Company, West Hartford 10, Conn.

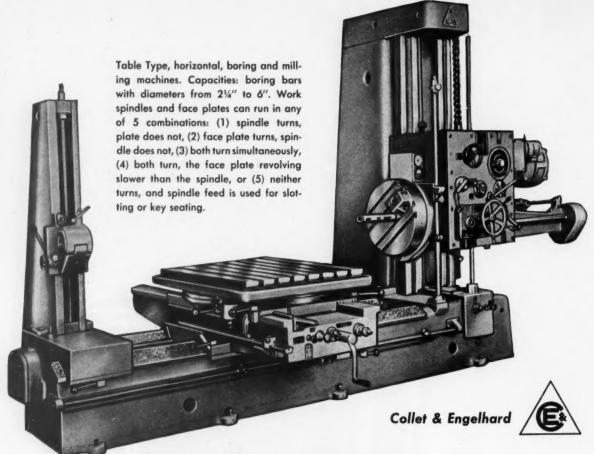


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Jacobs and your local distributor

are ready to deliver the chucks you need and the service you deserve.

- ... first in chucks
- ... first in service



FAMOUS...for a reason

work machined on a C & E has a high surface finish

... as high as C & E's reputation

Collet & Engelhard are Europe's leading builders of boring and milling machines. The reason—they have been building such machines for 90 years, and they apply the knowledge gained from such experience with painstaking care.

The horizontal boring and milling machine pictured above, a 3" Spindle Machine, is an excellent example of their work. Controls are simple, centralized, and located conveniently. Spindle speeds from 5 to 1600 rpm and face plate speeds from 5 to 250 rpm can be adjusted infinitely, while the machine is running. Spindle has 36 feeds, from .0008" to .472" per revolution and the facing head has 18 feeds from .0008" to .095" per revolution. Compound table and spindle head each have 36 feeds, from .0008" to .472". Boring and milling operations are free from vibration because of the heavy and rigidly braced bed and upright. Lubrication is automatic.

There are other desirable features about this machine—for instance, it has a tool locking and releasing device on the spindle nose that eliminates the ill effects of hammering wedges, it is convenient to set up for thread cutting, it has all possible safety devices, and many other advantages. However, the name of the builder is enough to tell you that it is one of the best machines you can get. Contact us for the complete story and you will soon find out how many of your boring and milling operations can be done better, faster, and safer, on the Collet & Engelhard.

COSA CORPORATION

CORPORATION
Your source for all Precision Machine Tools—
from Small Bench Lathes to Large Boring Mills

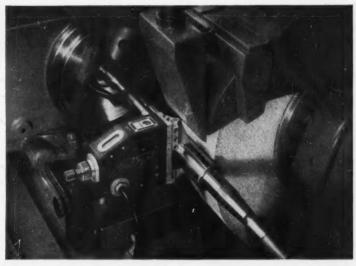
IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

Fortuna Cylindrical Grinders

Plain and Universal Types

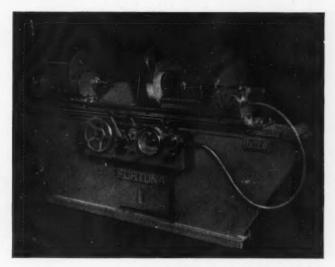


GRINDING



Finitor Automatic Sizing and Measuring Instrument, mounted on Fortuna Grinder, automatically controls grinding operations and holds size tolerances up to .00004".

Fortuna Grinders, for plunge cut or traverse grinding, are made in several types and sizes to accommodate workpieces up to 231/2" diameter and 88" between centers . . . To increase production efficiency these hydraulically operated machines have single lever control for all operations of a pre-determined set-up . . . Numerous attachments are available to increase production and simplify grinding operations . . . For extremely accurate work, the grinders can be equipped with FINITOR Automatic Sizing and Measuring Instruments that automatically control the grinding operations and hold size tolerances up to .00004".



Type ES630 Fortuna Cylindrical Grinder

Send us the details of your grinding jobs. Cosa engineers will recommend the proper Fortuna Grinder. Or, write for Catalog.

Your source for all Precision Machine Toolsfrom Small Bench Lathes to Large Boring Mills

contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

MACHINERY, May, 1953-293

1001 DRILLING SPEEDS INSTANTLY CHANGED

without stopping motor is a time-saving convenience that makes the "Buffalo" "RPMster" so popular in the finest shops. Motor and patented Variable Speed Drive are totally enclosed.

2 POWER FEED

all-geared construction — plus BACK GEARING 3 available.

4 6-SPLINE ALLOY STEEL SPINDLE precision machined and running on ball bearings.

ALL CONTROLS EASY TO REACH

by operator in normal working position.

AUTOMATIC FEED HANDLE REVERSE
TAPPING CONTROL Available

5 27" SPACE!

Here's a 13" overhang and 0" to 27" adjustment between working table and spindle nose.

For Shops that

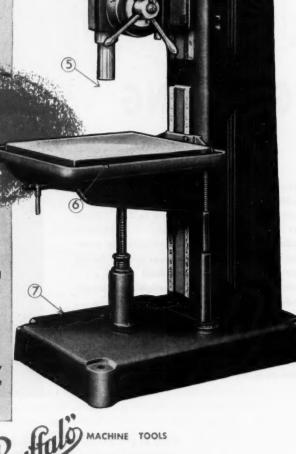
Demand the Finest

© 23"x 22" WORKING SURFACE crank-adjusted, with oil-and-chip channel and hand-scraped dovetail slide.

MASSIVE RIGIDITY FOR GREATEST ACCURACY and long life. Machine is 100" high.

WRITE FOR BULLETIN 3257A

for all details on this highly accurate, amazingly easy-to-handle machine used in many of the country's leading shops.





BUFFALO FORGE COMPA

BUFFALO, NEW

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING

PUNCHING

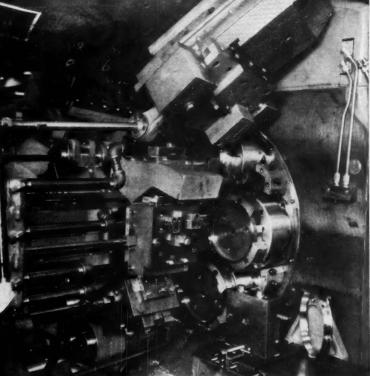
SHEARING

CUTTING

BENDING

ACME-GRIDLEY CHUCKERS take the TOUGH JOBS





This 8" Combustion Chamber Flange for jet engines is no job to be fooled with.

Machined from 8" diameter stainless steel blanks as shown, it presented first the problem of removing a lot of metal FAST—321 stainless is a difficult metal for precision results.

Tooling for accuracy and finish included both roughing and finish taper turning and boring attachments for the special angles and for holding the thin wall within .008 without danger of collapsing the piece.

All 13 operations were performed on the 10" Acme-Gridley Model RPA 6-spindle fully automatic Chucking Machine with carbide tipped tools at a net output rate more than 6 times faster than was possible on the turret lathe method formerly used.

Performances like this have demonstrated to the owners of more than 45,000 Acme-Gridley bar and chucking automatics that design rigidity and tooling ingenuity are your best insurance for sound production and profitable end results.

Acme-Gridley Chucking Automatics are built in 4, 6 and 8-spindle models with capacities ranging from 5% to 12".



Ask for guaranteed figures on your work—Tough jobs or otherwise.

JOB FACTS:

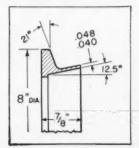
PART—Jet Combustion Chamber

SIZE—8" Diam., %" long

MATERIAL—Type 321 Stainless Steel

OPERATIONS—13, all with Carbide Tools

MACHINE TIME—1 minute, 16 seconds °



The NATIONAL ACME COMPANY

170 BAST 131st STREET

CLEVELAND & OHIO

Acme Gridley Bar and Chucking Automatics, 1-4 5 and 8 Spindle
—Hydraulic Thread Rolling Machines—Automatic Threading Dies
and Taps—Limit, Motor Starter and Control Station Switches—
Solenoids—Contract Manufacturing.

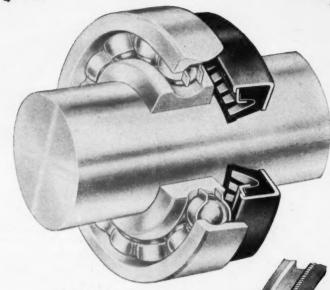
Best Bearing Protection Money Can Buy



Model 65—A general purpose garter spring seal for moderate speeds.



Model 63—A general purpose finger spring seal for normal and high speed service.



Model 53 KLOZURE applied to a shaft to protect the ball bearing.



Model 71-A—A narrowrind springless seal for needle bearings and other limited space applications.



Model 64—A strong double spring seal for heavy duty service on large shafts.

Model 91-B—A narrow-rind seal with synthetic rubber outer covering for soft metal housings.

DEPENDABLE KLOZURE Oil Seals protect costly bearing installations; they prevent breakdowns and resulting losses in production. That's why many manufacturers of machine tools, gears, speed reducers, and other equipment have standardized on Garlock KLOZURES.

The standard sealing element in the Garlock KLOZURE is made of a synthetic rubber compound that is oil-resistant, non-porous and non-abrasive. Special elements, such as "Teflon" for strong acids and silicone rubber for extreme heat, are available. The metal cases are precision die-stamped.

These superior oil seals are made in a complete range of sizes and in many models; several are illustrated. Write for KLOZURE Catalog No. 10.



Branch Offices in Principal Cities

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK Klozure Oil Seals

*Registered Trademark

FOR ALL TYPES OF BEARINGS

NEED AN INCLINABLE?



10 sizes - 6 to 200 tons

MAKE IT A FERRACUTE

Since 1863 Manufacturers of Power Presses & Special Machinery, FERRACUTE MACHINE CO., Bridgeton, N. I. U.S.A.



Vickols Miller

PRODUCTION MODEL

Precision turning, boring and recossing jobs that are normally assigned to toolmoker's tathes or expensive boring machines, come natural to the versatile NICHOLS

hapid Lever Actions on the Spindle Head, Table, and Saddle provide unparalleled flexibility of movements. The Lever Transversa Feed, an exclusive NICHOLS development, is especially valuable. Makes NICHOLS different from other hand millers. It adds "lathe-carriage flexibility" to my most intricate machining operations, while maintaining tolerances

"tenths." Work can be chucked

I the positive steps, quicking for on eliding movements, the highest degree of pracision and and equipment.

THE MILLER THAT BEES ITS WEAR



Longitudinal Table Travel

Transverse Table Travel

RAPID LEVER ACTIONS

Rise-and-Fall Spindle

W. L. DIE PELS, COMPANY, WALTHAM, MANSAGRUSETTS:



NICHOLS-MORRIS CORPORATION

76 E. MAMARONECK AVE., WHITE PLAINS, N. Y.

CONDENSED SPECIFICATIONS

Table Working Surface 64" x 21"

Longitudinal Table Travel 10"

Transverse Table Travel 7"

Vertical Travel of Knee 13"

Rise and Fall of Spindle 4½"

Selective Speed Ranges up to 5000 R.P.M.

Weight 1250 lbs.



Please remember that felt is not just felt, but is an engineering material, which can and should be specified as closely as any other. It is obvious that glass-polishing felt must be different from cushioning felt, but there are finer distinctions which should be taken into account if satisfaction is to be assured.

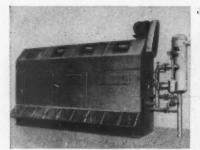
American, the largest and oldest felt manufacturer, makes 700 different mechanical types, each having exactly-controlled characteristics. For any given application there is a specification felt that is right for the job. To select this felt and establish it as a standard is your assurance of satisfaction with your product or process.

Like other materials, felt should be bought not on price, but on the quality required for a given application. If you will do that by adhering strictly to specifications and material standards you will find felt, American Felt, will serve you supremely well in protecting the reputation of your products. Our engineers will be glad to collaborate with you on establishing the correct specifications, and our mills will adhere strictly to those specifications when your order is received.



GENERAL OFFICES: 68 GLENVILLE ROAD, GLENVILLE, CONN.

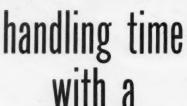
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MACHINE TOOL COMPONENTS Norton Company Worcester, Mass.

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ASK FOR A TIME STUDY

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Avenue, Philadelphia 32, Pa.



equipped for external grinding. Simplicity

reduces set-up time on the variety of work normal to the toolroom and die shop. Collets and step chucks quickly mount single or repetitive pieces.

The new Rivett 84 grinds holes from the smallest up to 3" diameter, with a maximum 4" depth depending upon diameter; external work to 3" diameter by 4" length.

If you need versatility with extreme accuracy, you will want to learn more about this new grinder. Send for Catalog 84.

- Optional Wheelheads for internal and external spindies.
- Internal Spindles 12,000 to 35,000 r.p.m.; sealed from grit and pre-lubricated for life.
- Lathe-Type Workhead Spindle mounts draw-in collets and step chucks directly. Micrometer Table Stop for positioning work when shoulder
- Mechanical Power Table Travel with infinite adjustment of
- Hand Table Travel with course and fine feeds graduated
- Hand infeed with coarse adjustment to .001", and fine to .0001" reduction of work diameter.



LATHE & GRINDER, Inc.

or Mare Precision Work RELY ON RIVETT LATHES AND GRINDERS, The Master Craftsman's Master Tools



who know and use good tools specify "Double Circle" because of

AUALIEV

The outstanding performance and long
life associated with Double Circle Tools
doesn't just happen. It is the result of exacting
inspection to secure top quality. This inspection and
quality check includes every individual tool. It starts with raw material
... and is carried out on every manufacturing operation
until the tool is checked out, finished and perfect ... a precision
product meeting rigid above-average standards.

It is the requirement of CHICAGO-LATROBE, makers of Double Circle Tools, to produce nothing less than precise, top quality tools that give outstanding performance and long life. Like "Old Hands" that recognize and know top quality, through long years of experience, you too, can enjoy using the best by specifying Double Circle Tools the next time you order.

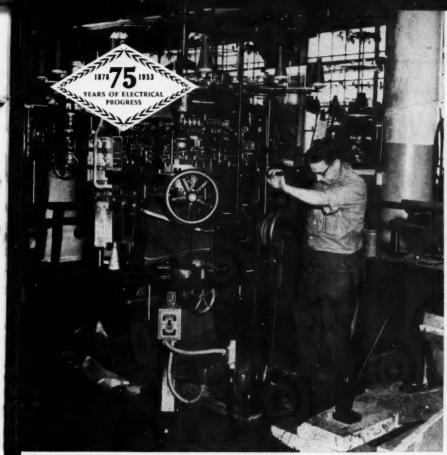
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DRILLS . REAMERS . COUNTERSINKS . COUNTERBORES . CARBIDE TOOLS . SPECIAL TOOLS



LIKE THE BAMBERGER-REINTHAL CORPORATION, CLEVELAND-YOU, TOO, CAN...

Modernize Your Equipment With New G-E Gear-motors

The Bamberger-Reinthal Corporation of Cleveland, Ohio recently converted to new G-E Gear-motors for machines knitting sweaters, shirts, stoles, and caps. Bamberger-Reinthal says: "These new G-E Gear-motors are much more efficient than our previous drive. They're the latest thing as far as we're concerned, and they're less expensive to operate and maintain."

G-E Gear-motors will modernize your operation too! Here's why:

G-E GEAR-MOTORS ARE COMPACT, requiring only a little more space than a regular constant-speed motor of the same rating. No external speed reduction equipment is necessary.

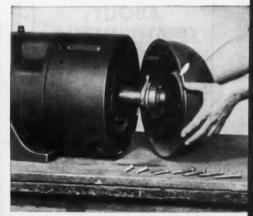
G-E GEAR-MOTORS ARE RUGGED.

They're engineered to give you years of dependable service under the most severe operating conditions.

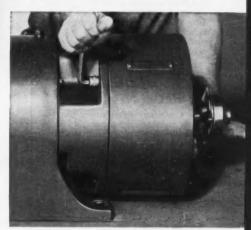
Assure yourself of getting the most efficient, easiest-to-maintain low-speed drive. Specify G-E Gear-motors.

A new stocking plan now makes oneweek delivery available on over 300 models. Order your G-E Gear-motor through your nearest G.E. Apparatus Sales Office, or your Authorized G.E. Agent or Distributor. General Electric Co., Schenectady 5, N. Y.

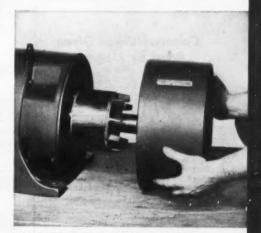
MAINTENANCE IS QUICK AND EASY



REMOVE ENDSHIELD FROM STATOR. If stator removal is required, it's never necessary to remove gear-motor from its foundation or disturb the gear train in any way.



UNBOLT STATOR FRAME BOLTS. Adapter located between motor frame and gear housing gives easy access to stator frame bolts. Note: no special tools are needed.



NOW THE STATOR MAY BE REMOVED. Entire job takes only minutes. This is only one of many features designed to cut "down time" up to 50 per cent.



NEWS **ABOUT** CREATED-METALS

Are Industry Inventories too High?

Business Week recently stated, "Don't underestimate the inventory problem. If a recession starts anytime in 1953, stocks of goods are likely to be at the bottom of it." Iron Age pointed out that, "hottest subject in automotive circles today is reducing tooling costs and shortening the tooling time cycle."



Informed sources in the field say that the Carboloy Minimum Tool Inven-tory Plan (described on these pages) is a forward step in answer to these problems as far as cutting tools are concerned.

Woodcutting Saws to Get New Teeth

The Carboloy organization has recently standardized production on 20 solid tungsten carbide tips for circu-lar woodcutting saws. Saws with these carbide tips will soon be available from a number of saw manufacturers and offer phenomenal



production increases over steel blades. Tool manufacturers can obtain details and prices by writing for Bulletin W.W.-53-1, Carboloy Department of General Electric Company (address at right).

Communications Given Boost by Magnets



Because they help eliminate costly, bulky coils, Carboloy permanent magnets are being used more and more in communications equipment. The list includes loudspeakers for shops, radio, TV . . . other electrical components in telephones, transmit-

components in telephones, transmit-ters, phonographs, hearing aids, etc. These are the same Carboloy per-manent magnets shop men find so useful for separating sheet steel, re-trieving tools, holding jigs and doing other handy, timesaving jobs.

YOUR CARBOLOY SALES REPRESENTATIVE SAYS ...

"Let us show you how up to 1/3



UR Minimum Tool Inventory Plan adopt plan that works! Under it, you stock a basic number of low-cost Standard Carboloy Tools in place of many costly "specials." The proposal shows you how to adapt these Standards to almost any single-point tooling job . . . simply and quickly. You use your regular carbide equipment. You'll cut down production delays. You'll reduce your inventories 30% or more. Read about it on these pages . . . "



GROOVING CHAMFERING RADIUS FORMING THREADING

What are Standard Carboloy Tools?

They are high-quality carbide-tipped single-point tools for turning, boring, facing and other machining operations. They outlast high-speed steel tools as much as 10 to 1 . . . will operate at machine speeds up to 4 or 5 times

faster than ordinary tools.

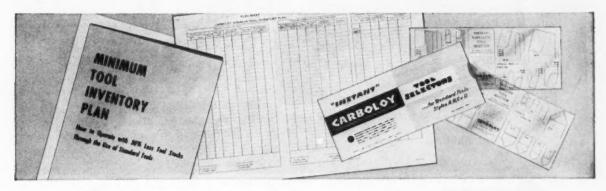
There are only 11 styles of Carboloy
Standards. They can be used "as is,"
or ground—in minutes—to do up to 80% of your single-point tool machining jobs. Carboloy Standards are as near as your phone, too. They are stocked in your area by Authorized Carboloy Distributors.

2 Here's how they adapt to your jobs.

At left is a style C Standard Carboloy Tool - one of the 11 styles. Note the generous-sized carbide tip. It can be used "as is" for some jobs . . . or adapted to meet any number of your special tooling requirements (as the 5 typical, adapted shapes at left, for example).

Carboloy Standards can be ground quickly in your own tool room, using an ordinary silicon carbide wheel for the rough grind, a diamond wheel only for sharpening. With a minimum stock of Standards on your shelves, you'll be able to get up to 80% of your single-point machining jobs rolling in

to reduce your single-point tool stocks . . . with Standard Carboloy Tools!"



3 Here's why the Minimum Tool Inventory Plan (MTIP) will work for you.

The Carboloy MTIP includes all the helps you'll need to standardize your single - point machining jobs with Carboloy Standard Tools. Send for the free MTIP kit. When it arrives: (1) Review your special single-point blueprints, using the handy plastic

Instant Tool Selectors (above) to choose in seconds the right Carboloy Standard Tool to adapt for each job. (2) Enter the findings on the Plan Sheet (above, center), filling in the "...Tools Recommended" section. That's all there is to it!

Now you can quickly compute what Standards you'll need, how many to stock, how much they'll cost. You'll see at a glance how the MTIP reduces your inventories up to one-third or more . . . lowers initial tool investment, shortens delivery cycles . . . gives you other benefits shopwide.

4 A Carboloy Sales Representative or Distributor will make sure it works.

Before you adopt this plan you can, if you wish, have a carbide expert from the Carboloy factory, district office or nearby Carboloy distributor come to your plant . . . help you get the MTIP rolling. He knows what carbide grades to recommend for particular jobs. He'll show you how Standard Carboloy Tools can pay for themselves in increased production and downtime savings alone. His services cost you nothing.



Carboloy Tools Are Stocked Coast To Coast By



Look under "Tools" in the Yellow Pages of your local telephone book, or in Thomas' Register, for your nearby Carboloy distributor. He has complete local stocks and can give you complete carbide service.

"Carboloy" is the registered trademark of the Carbolog

GET ALL THE FACTS. MAIL COUPON TODAY!

CARBOLOY

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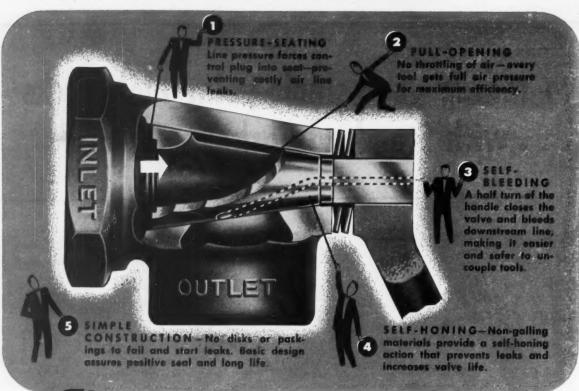
Please rush me, at no cast or obligation, full details on your Minimum Tool Inventory Plan.
 Have your representative call, without obligation.

Po.

ame Position______

Address

Zity______Zone__State



Five reasons why your air lines should have CLECA PRESSURE AIR VALVES



Cleco Air Valves pay for themselves over and over again in the air they save. Furthermore, by delivering full air pressure to the tools, they increase production.

> Cleco Air Valves are made in all styles shown and in all sizes from 1/4" to 1". Write for full information, including the name of your nearest dealer.



of the REED ROLLER BIT COMPANY, 5125 Clinton Drive, Houston 20, Texas, U.S.A.

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 - - MICHIGAN: Detroit, 18071 Wyoming Ave. CALIFORNIA: Los Angeles, 1317 Esperanza Street

PENNSYLVANIA: Philadelphia 20, 5220 N. Fifth St. . . . Pittsburgh: Room 621, Highland Bldg.

In Canada: Cleco Pneumatic Tool Company of Canada, Ltd., 927 Millwood Road, Toronto (Leaside), Ontario DISTRIBUTORS IN PRINCIPAL CITIES OF THE UNITED STATES AND THROUGHOUT THE WORLD

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations

ABRASIVE CLOTH, Paper and Belt

Carberundum Co., Buffalo Ave., Niagara Falls, N. Y. Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVE DISCS

See Discs, Abrasive.

ABRASIVES, HONING

Barnes Drill Co., 814 Chestnut St., Rockford, III.

ABRASIVES, Polishing, Tumbling, Etc.

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts.,
Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic

ACCUMULATORS, Hydraulic

American Steel Foundries, Elmes Engineering
Div., Paddock Rd. and Tennessee Ave.,
Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
Bethiehem Steel Co., Bethiehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St.,
Ansonia, Conn.
Greer Hydraulics, Inc., 454—18th St., Brooklyn
15, N. Y.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo,
N. Y.
Morgan Engineering Co., Alliance Chip.

Morgan Engineering Co., Alliance, Ohio, Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.

Mich. Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J. Wood, R. D., Co., Public Ledger Bldg., Phila-delphia 5, Pa.

AIR HOISTS-See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS

ALLOY STEELS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Bethiehem Steel Co., Bethiehem, Pa. Carpenter Steel Co., Reading, Pa. Carpenter Steel Co., of America, Chrysler Bldg., New York 1, N. Y. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa. Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa. Vanadium Alloys Steel Co., Latrobe, Pa. Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature

Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Aluminum

Aluminum Co. of America, Oliver Bldg., Pitts-burgh, Pa.

ALLOYS, Magnesium

Dow Chemical Co., Midland, Mich.

ALLOYS, Non-Ferrous

American Brass Co., 25 Broadway, New York.
Chase Brass & Copper Co., Inc., 1949 Rodney
St., Waterbury 20, Conn.
Haynes Stellite Div., Union Carbide & Carbon
Corp., 30 E. 42nd St., New York, N. Y.
Revere Copper & Brass Inc., 230 Park Ave.,
New York, N. Y.

ARBOR PRESSES

See Presses, Arbor.

ARBORS AND MANDRELS

Beaver Tool & Engineering Corp. (Arbors, only), 2850 Rochester Rd., Box 429, Royal Oak, Brown & Sharpe Mfg. Co., Providence, R. I.

Chicago-Latrobe Twist Drill Works, 411 W.
Ontario St., Chicago, III.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd
Ave., Chicago 50, III.
Erickson Tools, Div. Erickson Steel Co., 2309
Hamilton, Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St.,
Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St.,
Milwaukee 14, Wis.

Keo Cutters, 19326 Woodward, Detroit, Mich Morse Twist Drill & Mch. Co., New Bedford

National Tool Co., 11200 Madison Ave., Cleve-land, Ohio.

National Twist Drill & Tool Co., Rochester,

National Twist bring Mich.

Mich.

Pratt & Whitney, West Hartford 1, Conn.

Union Twist Drill Co., Athol, Mass.

Wesson Co., 1220 Woodward Heights Blvd.,

Ferndale, Mich.

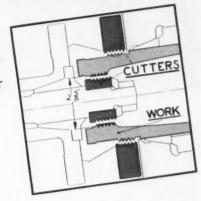
Whitman & Barnes, 40600 Plymouth Rd.,

Plymouth, Mich.

(Continued on page 310)

another job LL PLANETARY! for the

simultaneous milling of internal and external tbreads of different pitch!

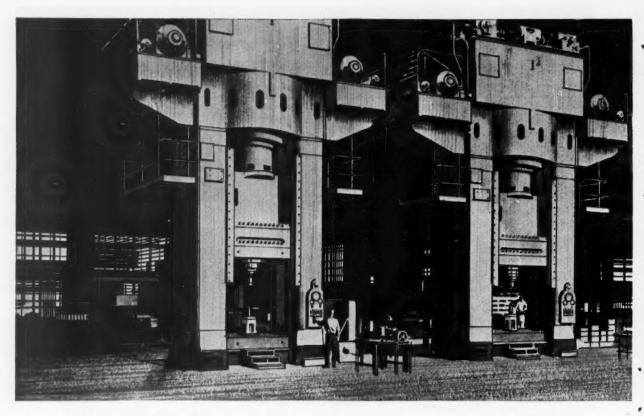


A job like this can be done only on the Hall Planetary. And, because the operations are performed simultaneously, threads are perfectly concentric.

Rotating eccentric containers in the Hall Planetary produce the exclusive plane-try movement. The spindle on which the cutters are mounted rotates within these eccentrics and moves in a circular arc from the center, entering the work near the extreme of the eccentric. The cutters then move around the circumfer-

ence of the work, completing the cuts and automatically returning to center in one cycle. The Planetary principle automatically removes, with no loss of time, the razor edge at the start and stop of threads. And here's another Hall Planetary advantage—the work is held stationary, a feature which simplifies the stationary, a feature which simplines the handling of parts which, because of their size or lack of concentricity, are not easily rotated. Furthermore, because the work fixture is secured to the head, accuracy and rigidity are assured.





World's first commercial facilities for producing parts by exclusive Mullins Steel *Koldflo* Process

Commercial facilities supported by specialized engineering and development departments are now available to industry for the production of parts by the exclusive Mullins Steel KOLDFLO* Process.

Now for the first time the economies of this process which shapes cold steel into finished parts is made available to American industry.

The Mullins Steel KOLDFLO Process is completely and exclusively different from any other extrusion process. The finished products come from the presses with smoothness, hardness, strength and precision required, and all of these features are acquired in the process from the use of low carbon, low cost steel.

The process can better and more economically

make a wide variety of finished products. Some of these products have already been produced and are shown on the opposite page. They are used in many different fields of manufacture.

The new and expanded facilities for commercial use make possible the production of cold-formed, hollow parts into finished shapes and a wide variety of configurations and are in lengths from 6" to 36" and in diameters from 2" to 6".

Because the Mullins Steel KOLDFLO Process is so new, the question "What is KOLDFLO?" has been asked us many times. To answer this question, we have prepared a booklet entitled "Product Design Guide."

This Design Guide will be valuable to executives, engineers and designers in studying the cost-saving possibilities of this process.

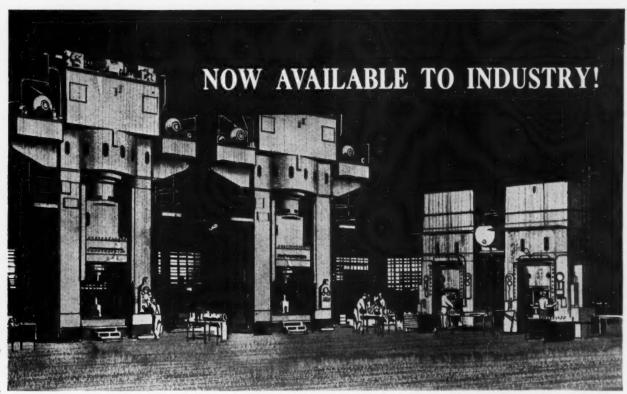


Send today for your free copy of "Product Design Guide."

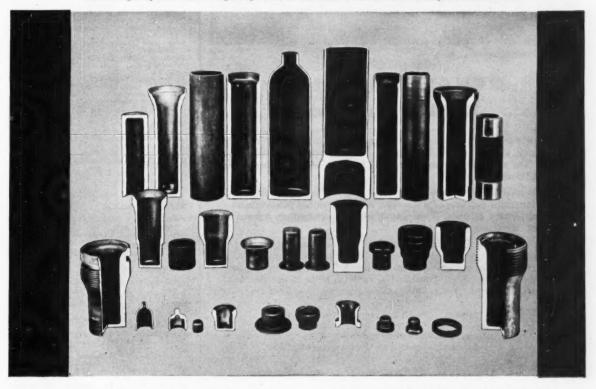
Koldflo Division

MULLINS MANUFACTURING CORPORATION
SALEM, OHIO

*KOLDFLO is a trade-mark of Mullins Manufacturing Corporation.



These six giant presses are the beginning of the Mullins Steel KOLDFLO commercial production facilities.



These parts have already been produced and hundreds of other similar parts can be produced by the Mullins

Steel KOLDFLO Process with a definite savings in steel, manpower, machine tools, plant space and dollars.



DYNAMIC STRAINS **Quickly Recorded**

 In this test on operating tractor parts at Caterpillar Tractor Company, strains are "picked up" with resistance-sensitive strain gages. The signal is then amplified and recorded—instantaneously by the Brush Analyzer.

Such immediate strain recording saves engineering time, and eliminates laborious plotting of data. The written records provide a permanent history of tests. This simplified measurement is a boon to product development.

Investigate Brush Recording Analyzers to streamline your testing of stress, strain, torque, vibration, pressure, and electrical characteristics. Brush representatives are located throughout the U.S. In Canada: A. C. Wickman, Limited, Toronto. For bulletin write Brush Electronics Company, Dept. Y-5, 3405 Perkins Avenue, Cleveland 14, Ohio.



PIEZOTRONICS... Brush has prepared this informative 24-page brochure describing the functions and applications of piezo-electric materials. Write for your copy—it may spark a product improvement idea.

BRUSH ELECTRONICS

INDUSTRIAL AND RESEARCH INSTRUMENTS PIEZOELECTRIC MATERIALS . ACOUSTIC DEVICES MAGNETIC RECORDING EQUIPMENT ULTRASONIC EQUIPMENT



COMPANY

formerly
The Brush Development Co. Brush Electronics Company is an operating unit of Clevite Corporation.

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Bunting Brass & Bronze Co., Spencer and Carl-ton Aves., Toledo, Ohio. Johnson Bronze Co., New Castle, Pa. Ryerson, Jos. T., & Son, 2558 W. 16th St., Ryerson, Jos. T., Chicago 18, III.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, III.
Gisholt Machine Co. (Static and Dynamic), 1245
E. Washington Ave., Madison 10, Wis.
Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, III.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J. Kennametal, Inc., Latrobe, Pa. S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.

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BARS, Steel

Allegheny Ludium Steel Corp., Pittsburgh, Pa. Bethlehem Steel Co., Bethlehem, Pa. Carpenter Steel Co., Reading, Pa. Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.

Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.

LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio. Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicaga 18, Ill.

Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio. Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

Timken Roller Bearing Co., Canton, Ohio. U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Po.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

burgh, Pa. Wheelock, Lovejoy & Co., Inc., Cambridge,

BEARINGS, Bobbitt

Bunting Brass & Bronze Co., Spencer and Carl-ton Aves., Toledo, Ohio. Johnson Bronze Co., New Castle, Pa. Link-Belt Co., 2410 W. 18th St., Chicago 8, III.

BEARINGS, Bell

BEARINGS, Bell

Aetna Ball & Roller Bearing Co., 4612 Schubert
Ave., Chicogo, III.

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North
Quincy, Mass.

C & C Sales Corp., 1771 Broadway, New York
19, N. Y.

Fafriir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St.,
Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis
6, Ind.
Mariin-Rockwell Corp., 402 Chandler Bldg.,
Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia,
Po.
Norma-Hoffmann Bearings Corp., Stamford, Norma-Hoffmann Bearings Corp., Stamford,

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(Continued on page 312)

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famous Hanson Processes

Hydraulic Thread Milling Machine

new features

Hydraulic-driven cutter and work spindles insure balanced cutter speed and work feed - provide rapid traverse carriage. Variable cutter speeds up to 3,000 R. P. M. make possible instant adjustments during operating cycle. High speed permits efficient use of carbide cutters where applicable. The famous Hanson features of interchangeable lead cams, cross-feed cams, and completely semi-automatic operating cycles are retained in these machines.

The Most Revolutionary Improvement in Thread Milling Since the Invention of the Thread Milling Machine in 1901 by the Late B. M. W. Hanson, Founder of the Com-

Extensive field tests prove increased production, accuracy, and improved finishes. Production costs cut in half . . . cutter life three times greater.

Manufactured in the following capacities: 4" x 9", 10" x 24", 15" x 30", and 20" x 48". Longer beds to suit customers' requirements.

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the HANSON

"Hanson Processes" will offer you

conomical solution. Investigate today





Never Be

ADVANTAGES for HIGHEST PRODUCTION

4800 PER HOUR! 3800 PER HOUR! 2500 PER HOUR!



FULL UNIVERSAL MACHINE

Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:

DRILLING

Crossdrill and C"T" Sink 1/16" Hale

Material—Brass Production-4800 per hour Fixture—#15 Vertical index Equipment—#1-UD Drilling Machine



TAPPING

Tap Two #10-32 Holes

Material—Steel stamping Production-3800 tapped holes per hour

Fixture-#14 horizontal index Equipment—#1-UT tapping



THREADING

3/8'-24 Thread-1/2' Long

Material—Die Cast Aluminum Production—2500 per hour Fixture-#10 Drum dial Equipment - #3-TR Threading machine



Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures All types of air operated automatic and semi-automatic ligs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production. Sensitivity of power application prevents tool breakage.

Simplicity of control means that set up and aperation can be handled by a fess Experienced operator with minimum fettigue.

Submit Sample Parts f

MANUFACTURING COMPANY 435 Eastern Ave., Bellwood, Illinois (Chicago Suburb) Single Spindle Verticals • Two-Spindle Vertioringie opiniare vernicais « rwe-opiniare vernicais » Twe-Spindle Horizontals » Automotic Ny Tapping Machines » Drill Press Tap Heads » Automotic & Semi-Automotic Jigs

BEARINGS, Bronze and Special Alky

Bunting Brass & Bronze Co., Spencer and Cari-ton Aves., Toledo, Ohlo. Haynes Stellitte Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y. Johnson Bronze Co., New Castle, Pa. Link-Belt Co., 2410 W. 18th St., Chicago 8, III.

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BEARINGS, Lineshaft

Fafnir Bearing Co., New Britain, Conn. Link-Belt Co., 519 N. Holmes Ave., Indianapolis Link-Beit Co., 519 N. Holling Ave., Hands Ave., 11d. 6, Ind.
6, Ind.
Shafer Bearing Corp., Downers Grove, Ill.
5 K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

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C & C Sales Corp., 1771 Broadway, New York 19, N. Y. 19, N. Y. Kaydon Engineering Corp., McCracken St., Muskegon, Mich. Orange Roller Bearing Co., Inc., Orange, N. J. Torrington Co., Torrington, Conn.

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Aetna Ball & Roller Bearing Co., 4612 Schubert Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, III.
Ball & Roller Bearing Co., Danbury, Conn.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6. Ind. 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg.,
Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford,
Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St.,
Syracuse, N. Y.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North
Philadelphia, Pa.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn. 6. Ind.

BEARINGS, Self-Lubricating (Oilless)

Bunting Brass & Bronze Co., Spencer and Carl-ton Aves., Toledo, Ohio. Johnson Bronze Co., New Castle, Pa.

BEARINGS, Taper-d Roller

C & C Sales Corp., 1771 Broadway, New York 19, N. Y. Jergens, J. G., Co., 11106 Avon Ave., Cleve-land 5, Ohio. Kaydon Engineering Corp., McCracken St., Muskegon, Mich. Timken Roller Bearing Co., Canton, Ohio. Torrington Co., Torrington, Conn.

BEARINGS, Thrust

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill. Ball & Roller Bearing Co., Danbury, Conn. Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn. General Electric Co., Schenectady, N. Y. Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bidg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa. Aetna Ball & Roller Bearing Co., 4612 Schubert Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Shafer Bearing Corp., Downers Grove, III.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

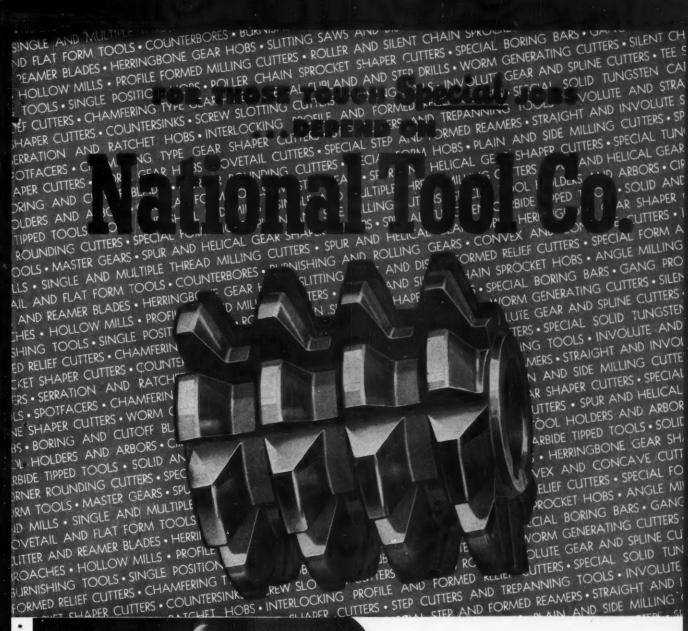
BELT SHIFTERS

Standard Pressed Steel Co., Jenkintown, Pa.

BELTING TRANSMISSION

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa. Link-Belt Co., 220 S. Belmont Ave., Indian-apolis 6, Ind.

(Continued on page 314)



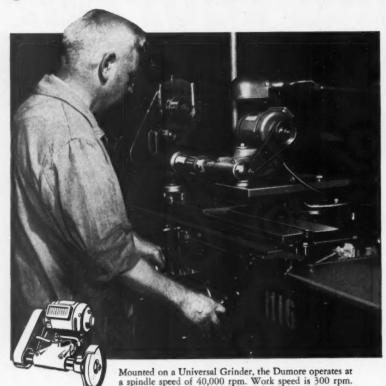


Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 46 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

Since 1905 engineers and manufacturers of high-quality special cutting tools for the metal-working industry

National
TOOL CO.
Cleveland 2, Ohio

26-year record proves DUMORE GRINDERS give low-cost, accurate service



How DUMORE insures high-speed internal grinding . . . mirror finish at low cost

PRODUCING drill chucks requires a difficult jaw grinding operation. Smooth finish and correct back taper are necessary. And each day, the grinder must withstand millions of hammer-like blows transmitted to the grinding wheel and spindle bearings.

Since 1927, this chuck manufacturer has used DUMORE precision grinders. Here is his report:

"Our Dumore No. 5 units operate 100 hrs. weekly to internal grind open jaws for our 1/8" to 1" plain bearing key type chucks. Material is 60 Rockwell C hardness alloy steel. We remove .005".

"The Dumores are well adapted to this fine work and produce a glass-like finish. Their sturdy power transmission, solid spindle shaft, self-oiling features, air-cooled motor and variable speeds make them exceptionally well suited for this work. They deliver continuous operation with little effort and very low maintenance cost."

If you're seeking to improve internal grinding operations, investigate the advantages Dumore grinders provide. Get details from your industrial distributor or write direct:



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Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethiehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, III.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

BENDING MACHINES, Pipe

Buffale Forge Co., 490 Broadway, Buffalo, N. Y. O'Neil-Irwin Mfg. Co., Lake City, Minn. Pines Engineering Co., Inc., Aurora, Iil. (Hydrauli) Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT

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BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y. Ingersoil-Rand Co., Phillipsburg, N. J. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio. Westinghouse Electric Corp., Pittsburgh 30, Pa.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center
No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Steel and Tubes Div.,
Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th
St., Chicago 18, III.
U. S. Steel Corp., National Tube Co., Dlv.,
436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY

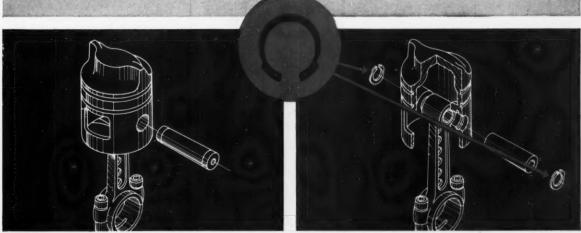
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio. Hill Acme Co., 1201 W. 65th St., Cleveland 2. Ohio. Landis Machine Co., Inc., Waynesboro, Pa. National Machinery Co., Tiffin, Ohio. New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

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Bethiehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland I, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

(Continued on page 316)

2 Waldes Truarc Rings Replace 2 End Plugs .. Eliminate 3 Operations... Save 5.066 Per Unit



OLD WAY Two inserted-plug type wrist pin locks hold wrist pin in place. 3 operations involved: costly machining, pressing in place, post-assembly machining. Costly maintenance problem—resulting from end plugs hammering loose.

TRUARC WAY Two Truarc Inverted Retaining Rings (Series 5008) hold wrist pin in place. Truarc Rings snap into grooves easily cut in piston, provide positive lock . . . practically eliminate maintenance costs. Quick assembly, disassembly.

Titan Chain Saws, Inc., Seattle, Washington, uses 2 Waldes Truarc Rings to replace old-style inserted-plug type wrist pin locks in their Titan chain saws. Use of Waldes Truarc Retaining Rings eliminates 2 press fit end plugs. Machining of plugs, pressing in place, finish machining—no longer required. Truarc way holds rejections to a minimum. Unit efficiency is greatly increased.

Redesign with Truarc Rings and you, too, will cut costs. Wherever you use machined shoulders, bolts, snap

USE	0F	2	WALD	ES	TRUAF	C	RI	INGS
PERM	TTE	D	THESE	SA	VINGS	PE	R	UNIT:

OLD WAY

Cost of 2 end plugs
Cost of pressing in and machining . \$.169

TRUARC WAY

Cost of grooving piston Cost of 2 Truarc Rings

Saving per Unit \$.066

rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better job of holding parts together.

Waldes Truarc Rings are precisionengineered... quick and easy to assemble and disassemble. Always circular to give a never-failing grip. They can be used over and over again.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc engineers for individual attention, without obligation.

For precision internal grooving and undercutting...Waldes Truarc Internal Grooving Tool.



RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK WALDES TRUMAR RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 2,302,347; 2,322,446 2,412,412,240,221; 2,423,412, 2,433,732; 2,441,446; 2,445,145; 2,445,146; 2,445,346; 2,445

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SCROLL CHUCKS Self-centering models for light, medium and heavy duty jobs in tool room or for production runs. Available in sizes from 3" to 18" with semi-steel or forged steel bodies, and heat-treated alloy steel for all other parts. Provided with two sets of solid jaws or two-piece jaws for holding internal or external work. Lands on the jaw, jaw steps and end bites are ground after the chuck is assembled.

INDEPENDENT CHUCKS Models for medium and heavy duty tool room and general machine shop work. Available in sizes from 4½" to 36" with semi-steel, steel, or forged steel bodies. All other parts are heat-treated alloy steel. Jaws are solid reversible or two-piece with reversible tops for either internal or external gripping. The body surrounds more than 60%of each operating screw for the full length of the screw to assure proper alignment at all times.

AIR & POWER CHUCKS Self-centering models for heavy duty production work on engine and turret lathes and automatics. Sizes from 6" to 24" with forged steel bodies, and with either 2 or 3 jaws are available. The wedge angle is such that work is gripped positively regardless of jaw position. The chuck will not release the work, even if air line is broken, until operator actuates draw bar. Skinner also has a complete line of power chucking accessories.

MACHINE VISES Skinner vises are accurate, fast acting and positive gripping. Series DPV wrench-operated Vises have semi-steel body and hardened and ground work holding surfaces. They have all the universal features so necessary for drill press operations. Clamp the work for drilling in one plane drill — turn the vise on edge for all right angle drilling operations.

Series FS Vises have swivel base for accurate indaxing necessary in milling operations. Top of the movable jaw is ground parallel to the base for use as an indicating base for setting cutters, trueing work, etc.

Details on the full line of products are included in Skinner General Catalog —write to the company or your nearest Skinner distributor for a free copy!

THE SKINNER CHUCK COMPANY 206 Edgewood Ave., New Britain, Conn.





BOLTS, T-Slot

Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philodelphia, Pa.

BOOKS, Technical

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Barnes, W. F. & John, Co., 201 S. Water St.,
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Bulland Co. Brewster St. Bridgeport 2. Copp. Rockford, III.

Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co.,
Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32 Mich.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, III.

Moline Tool Co., 102 20th St., Moline, III.

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

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Lac, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York, 17, N. Y.
Triplex Machine Tool Corp., 75 West St., New
York 6, N. Y.

BORING BARS

BORING BARS

Adamas Carbide Corp., 999 South 4th St.,
Harrison, N. J.

Apex Tool & Cutter Co., Inc., 237 Canal St.,
Shelton, Conn.

Armstrong Bros. Tool Co., 5200 W. Armstrong
Ave., Chicago, III.
Beaver Tool & Engineering Corp., 2850
Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237,
Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis
Machine Tool Co., Fond du Lac, Wis.
Erickson Tools, Div. Erickson Steel Co., 2309
Hamilton, Cleveland, Ohio.

Ex-Cell-O Corp., 1200 Ookman Blvd., Detroit
32, Mich. 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pitts-burgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich. 32, Mich. Homestrand, Inc., Larchmont, N. Y. Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill. Lehmann Machine Co., 3560 Chouteau Ave., Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo. Lovejoy Tool Co., Inc., Springfield, Vt. Madison Mfg. Co., Muskegon Heights, Mich. Maxwell Co., 420 Broadway, Bedford, Ohio. McCrosky Tool Corp., 1938 Thomas St., Mead-ville, Pa. Neise, Karl A., Dept. M., 381 Fourth Ave., New York 16, N. Y. Universal Engineering Co., Frankenmuth 2, Mich.

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(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366
Beekman St., Cincinnati 23, Ohio.
Espen-Lucas Machine Works, Front St. and
Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Giddings & Lewis Machine Tool Co., Fond du
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Gray, G. A., Co., Woodburn Ave. and Penn.
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WALSH

Rugged Walsh presses made in 1907 are still operating at a profit.

For press recommendations without obligation send sample or blueprint to Engineering Department, Walsh Press & Die Co., Division of American Gage & Machine Co., 4709 W. Kinzle St., Chicago 44, ESterbrook 8-6700.

38x

WALSH PRESSES STILL IN USE MADE IN 19

All presses lubricated and run-in will Molykote at the lactory.

WALSH PRESS & DIE COMPANY



This recent Goss & DeLeeuw development has already received universal acclaim as an outstanding development.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages

which result in vastly greater production at a fraction of parts' costs by other methods.

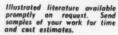
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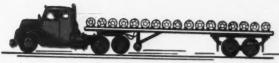
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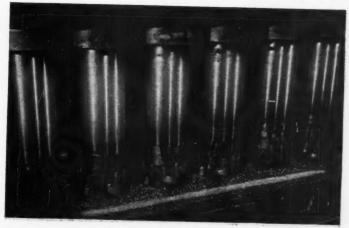
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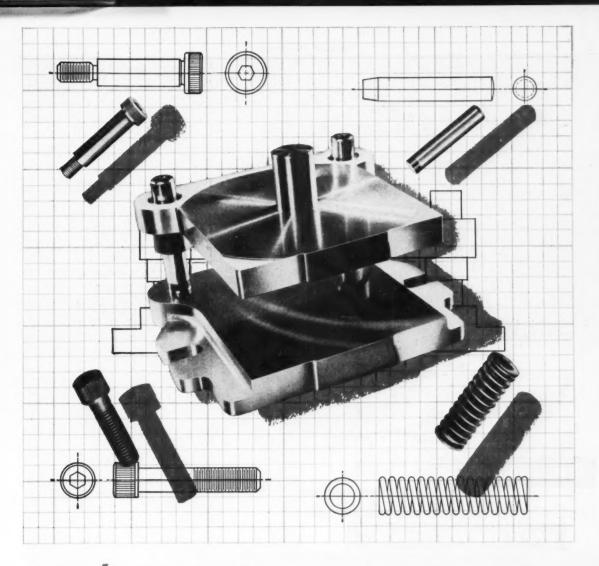
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(Continued on page 326)

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Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

Standard 1001 Co., 3930 Crester Ave., Cleve-land, Ohlo.
Warner & Swasey Co., 5701 Carnegle Ave., Cleveland 3, Ohlo.
Zogar Tool, Inc., 24000 Lakeland Blvd., Cleve-land 23, Ohlo.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. 1. DoAll Co., 254 Laurel Ave., Des Plaines, III. Hanchett Magna-Lock Corp., Big Rapids, Mich. Taft-Peirce Mfg. Co., Woonsocket, R. 1. Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Erickson Tools, Div. Erickson Steel Co., 2309
Hamilton, Cleveland, Ohlo.
Errington Mechanical Laboratory, 24 Norwood
Ave., Stapleton, S. I., N. Y.
Jarvis, Charles L., Co., Middletown, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohlo. National Tool Co., 11200 Madison Ave., Cleve-land, Ohio. Neise, Karl A., Dept. M, 381 Fourth Ave., New York 16, N. Y. Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, III. Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Homestrand, Inc., Larchmont, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Mead-ville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y. Westinghouse Electric Corp., Pittsburgh 30, Pa.

CLAMPING APPLIANCES FOR MACHINE TOOLS

Neise, Karl A., Dept. M., 381 Fourth Ave., Tinicum Ave., Philadelphia, Pa. Swartz Tool Products Co., Inc., 13330 Foley Ave., Detrolt, Mich.

CLAMPS

deliveries

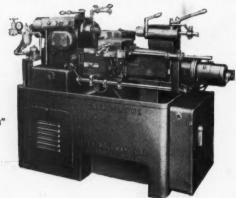
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III. Brown & Sharpe Mfg. Co., Providence, R. I. Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, III.

(Continued on page 330)



RIGIDITY & P

to take heavy, high-speed cuts on high-Brinell and tough steels



Swing over bed-12" Swing over cross slide-7" Distance between centers-Floor Space—31" x 51" 10 H.P. Motor Feeds-.003" to .030"

Faster, more accurate with carbide tools LIPE Carbo-Lathes

with complete cycle electrically controlled

Bed and headstock cast in one piece from 500 pounds of chromemolybdenum-iron! Massive tailstock with a 3" diameter quill! Heavy bed sidewalls reinforced by cross ribs! These are the reasons why the Lipe Carbo-Lathe eliminates all deflection and weaving - why it is rigidly resistant to torsional stresses and strains.

Brute power and a wide range of selective speeds permit hogging feeds and cuts on high-Brinell steels, scaly surfaces, weld spots and jump cuts. Designed for carbide tools, this lathe insures faster, more accurate work.

More, the complete cycle can be electrically controlled. A push on the starter button starts the spindle, moves the carriage to the cutting position, automatically engages the mechanical feed. At the end of the

cut, the feed disengages, the spindle stops and the carriage returns quickly to the loading position. At every point in the cycle the operator has complete manual control.

Bring Your Present Lipe Carbo-Lathes Up to Date . . .

Lipe automatic cycle attachment may be applied to any Lipe Carbo-Lathe bearing a serial number of 200 or greater. See your Lipe distributor for full details.

Lipe Carbo-Lathes are sold with or without Automatic Cycle Attachment. Write for further information and delivery dates.



DoAll Co., 254 Laurel Ave., Des Plaines, III. Lufkin Rule Co., Hess Ave., Saginaw, Mich. Mead Specialties Co., 4114 N. Knox Ave., Chicago 41; III. Rivett Lathe & Grinder, Inc., Brighton, Boston 35 Mass. Rivett Latine & Grinder, Inc., Brighton, Boston 35, Mass. Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa. Starrett, The L. S., Co., Athol, Mass. Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn. Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES

Clearing Mch. Corp., 6499 W. 65th St., Chicago Ansonia, Conn.

Formsprag Co., 23609 Hoover Rd., Van Dyke, Mich. Link-Belt Co., 300 West Pershing Rd., Chicago Link-Bett Co., 300 West Persning Rd., Chicago 9, III. Lipe-Rollway Corp., 806 Emerson Ave., Syra-cuse, N. Y. Rockford Jiutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, III. Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indian-apolis 6, Ind. Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I. Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio. Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Praft & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, III. Eastman Kodak Co., Rochester, N. Y. Jones & Lamson Mch. Co., Springfield, Vt. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa. Oakite Products, Inc., 19 Rector St., New York, N. Y.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, Cities Service On Co., 7. Co., 1975.

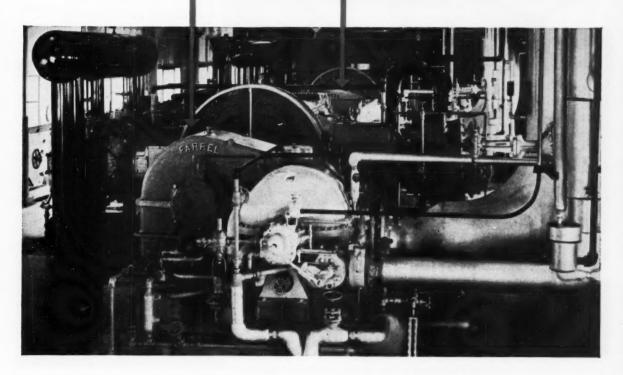
N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave.,
Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean
Ave., Detroit 2, Mich. (Broaching & Lapping).
Oakite Products, Inc., 19 Rector St., New York,
N. Y.

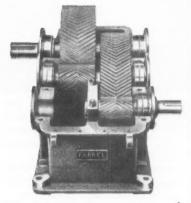
N. Perining Co., 630 5th Ave., New York. N. Y. Sinclair Refining Co., 630 5th Ave., New York. Standard Oil Co. (Indiana) 910 S. Michigan, Standard Oil Co. (Indiana) 910 S. Michigan, Chicago, III. Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, III. Sun Oil Co., 1608 Walnut St., Philadelphia, Pa. Texas Co., 135 E. 42nd St., New York, N. Y. Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

(Continued on page 332)

THESE SPEED REDUCERS HANDLE

A TOUGH JOB WITHOUT COMPLAINT





Each of these Farrel® double-reduction gear units is transmitting 920 HP from a turbine to a Cooper-Bessemer M-Line compressor. They are located at the Billings (Montana) refinery of Continental Oil Company.

This is a difficult assignment for any speed reducer. The high-speed operation (4000/300 RPM) really "tests" the design and workmanship of the gear unit.

How well these two Farrel units have performed on this tough job is a matter of record—almost three years of continuous operation, with a minimum of down time for routine inspection and maintenance.

Farrel speed reducers have a number of advantages which account for their outstanding performance records. The quiet, vibration-free operation of the herringbone gears results from extreme accuracy of tooth spacing, contour and helix angle — qualities inherent in the Farrel-Sykes method of gear generation. Precision manufacture and highest-grade materials contribute to long gear life.

Write for further details of these outstanding units. Ask for a copy of Bulletin 449.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

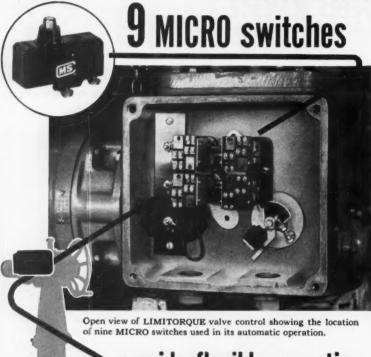
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Baston, Pittsburgh, Akron,
Detroit, Chicago, Memphis, Minneapolis, Portland (Oregon), Los Angeles, Salt Lake City, New Orleans

OIL FIELD REPRESENTATIVES

Hercules-Lupfer Engine Sales Co., 124 N. Boston St., Tulsa 1, Okla. V. W. Osborne, 860-A M & M Building, Houston 2, Texas

FR.814

Farrel-Birmingham



 provide flexible operation of this Philadelphia **Gear Valve Control**

• Fast, snap-action MICRO switches provide a flexibility of control hitherto unknown in the operation of Limitorque Automatic Controls for the operation of valves on steam, air, gas, water and oil lines.

Nine MICRO switches are used in the 4-train gear limit assembly. Eight switches permit various adjustments in the gear train to open and close different circuits with rotations of the drive shaft. The ninth switch cuts off the motor when the design torque load is exceeded.

Engineers of Philadelphia Gear Works, makers of Limitorque Controls, chose MICRO switches for this use because of:

- 1 High electrical capacity.
- 2 Extremely rapid make-and-break action:
- 3 Provision of more electrical circuits.
- 4 Small size to aid compact design.

This selection of MICRO switches as important components of equipment which must give years of long-life performance is typical of the confidence placed in MICRO products by design engineers in every phase of industry. MICRO field engineers, with more than 6,000 varieties of precise snap-action switches from which to choose, are available to consult with you on the most complex switching problems. We invite you to contact the nearest MICRO branch office.

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

KERS OF PRECISION SWITCHES FREEPORT, ILLINOIS

COMPOUNDS, Resin and Molding

Bakelite Co., Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y. General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Ingersoil-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Taol & Mch. Co., 955 Cleveland
Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave.,
Syracuse, N. Y.
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, Eisler Engrg. Co., Inc., 760 S. 13th, Newark S, N. J. Fellows Gear Shaper Co., Springfield, Vt. Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich. Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn. Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio. Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio. Minster Machine Co., Minster, Ohio. Morse Twist Drill & Mch. Co., New Bedford Mass. Mummert-Dixon Co., Hanover, Pa. National Acme Co., 170 E. 131st St., Cleveland, Ohio Ohio. Rivett Lathe & Grinder, Inc., Brighton, Boston Rivett Lathe & Grinder, Inc., Brighton, boston, 35, Mass.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohlo.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis. Bristol Co., Platts Mills, Waterbury, Conn. General Electric Co., Schenectady 5, N. Y. Westinghouse Electric Corp., Pittsburgh 30, Pa.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, III. Link-Belt Co., 300 W. Pershing Rd., Chicago 9,

COOLANT SEPARATORS

See Separators, Oil or Coolant

COUNTERBORES Adamas Carbide Corp., 999 South 4th St., Harrison, N. J., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co, Rochester, Mich.
Prat & Whitney, West Hartford 1, Conn. Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13,
Alich

Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(Continued on page 334)

Here's how this strainer "combs" itself clean!

This simple chalk test shows how AUTO-KLEAN's unique built-in comb construction cleans the strainer without costly interruption of flow



ORDINARY BLACKBOARD CHALK leaves heavy deposit of chalk particles on and between discs of Cuno AUTO-KLEAN strainer.



TURNING HANDLE ONE REVOLUTION moves strainer element
through comb blades, removing
all traces of chalk from between
discs. Cuno's exclusive combing
operation cleans thoroughly
—without stopping flow.



FILTERING AREA IS COMPLETELY CLEAN, restoring full initial capacity. All chalk particles and dirt fall to bottom of housing where they can be drained periodically.

- AUTO-KLEAN's permanent metal filter element is available in steel, brass, or stainless steel for long, trouble-free service.
- AUTO-KLEAN is adaptable to any fluid-flow system.
- From acids to tar . . . if you can pump it, Cuno can filter it. Capacities range from one gallon per hour to 15,000 gallons per minute.



AUTO-KLEAN (disc-type) . MICRO-KLEAN (fibre cartridge) . FLO-KLEAN (wire-wound)

SINGLE-STRAINER PROTECTION FOR LUBE OILS AND PROCESS FLUIDS

Continuously cleanable AUTO-KLEAN eliminates need for stand-by strainers

AUTO-KLEAN's compact construction gives you full-flow operation in space which would limit ordinary filters to by-pass service. The low pressure drop of AUTO-KLEAN strainers permits this full-flow service on gravity, low pressure, high pressure, or suction lines—with no loss in operating efficiency.

Cuno's exclusive "comb-clean" action provides complete cleaning of the filter element—without stopping fluid flow. Thus, there's no need for a stand-by strainer.

The low maintenance costs of the AUTO-KLEAN save you money, for there are no cartridges to change. An occasional rotation of the handle does the cleaning job (most units can be equipped with motor-drives for continuous cleaning).

Fixed-space metal discs in this modern strainer positively remove all solids larger than the specified disc spacing—from .0035" up to .062".

For permanent, positive fluid protection, install compact Cuno AUTO-KLEAN—the precision-built strainer. Send the coupon for free bulletin.

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C-ENGINEERED ECIAL CUTTING TOOLS







Next time you're up against a tough tooling problem, call in the man who can give you the right answers fast . . . your nearby Gorham Field Engineer! He's an expert in special cutting tools ... and he's ready to provide a complete en-gineering service to determine your exact tooling requirements. He starts with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and desired finishes and tolerances. He plots proper machine feed, speed and method of tool driving. Then he develops practical design and engineering specifications for special cutting tools, metallurgically "tailor-made" for your application.

His recommendations are backed by Gorham's unmatched facilities, which include three fullyequipped modern plants, a large Engineering and Metallurgical staff, and a force of field application engineers in principal industrial centers, coast-to-coast. All are dedicated to furnishing prompt and profitable solutions to your special tooling problems. Gorham-engineered "specials" are turning problems into profits in thousands of plants every day . . . why not let them do the same for you? If you haven't met your nearby Gorham Field Engineer, write for his name, or send details of your problem direct for recommendations.

AM TOOL COMPANY

EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

14405 WOODROW WILSON **DETROIT 3, MICHIGAN** WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, III.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32 Mich.

32, Mich. piring Tool Co., 21225 Hoover Rd., Detroit

32, Mich.
Goring Tool Co., 21225 Hoover Rd., 2011
32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Greenfield Top & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon
Corp., 30 E. 42nd St., New York.
Morse Twist Drill & Mch. Co., New Bedford,

nal Twist Drill & Tool Co., Rochester,

National Twist Children and Conn. Mich.
Peck, Stow & Wilcox Co., Southington, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Super Tool Co., 21650 Hoover Rd., Mich. Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution

Bristol Co., Platts Mills, Waterbury, Conn. Brown & Sharpe Mfg. Co., Providence, R. I. Millers Falls Co., Greenfield, Mass. Starrett, The L. S., Co., Athol, Mass. Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUNTING DEVICES

Starrett, The L. S., Co., Athol, Mass. Veeder-Root, Inc., 20 Sargent St., Hartford,

COUPLINGS, Flexible

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, III.
Link-Belt Co., 220 S. Belmont Ave., Indian-apolis 6, Ind.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Boston Gear Works, 3200 Main St., North Quincv, Mass. James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, III. Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa. Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio. Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J. Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio. Morgan Engrg. Co., Alliance, Ohio.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich. Fellows Gear Shaper Co., 78 River St., Spring-field, Vt. Hanson-Whitney Co., Div. Whitney Chain Co.,

Hartford, Conn. inois Tool Works, 2501 North Keeler Ave.,

Harron, Tool Works, 2501 Round Rd. Chicago, III. Michigan Tool Co., 7173 E. McNichols Rd., Detroit 12, Mich. Morse Twist Drill & Mch. Co., New Bedford,

Detroit 12, Mich.
Morse Twist Drill & Mch. Co., New Bedford,
Mass.
National Broach & Mch. Co., 5600 St. Jean
Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham,
Mass.

Mass. Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich. Ferndale, Mich.
(Continued on page 336)

181 Air Hoists

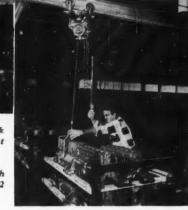
...selected by Cleveland FORD Foundry

Production lines
equipped with
Ingersoll-Rand
Air Hoists



Closing the molds on the 6-cylinder block line with Size BN Hoists and Pendent Throttle.

End of the line . . . Size LC-2 Hoist with Pendent Throttle speeds the loading of 12 finished blocks on special skids.



The Pendent Throttle for controlling the Size BN Hoist is mounted on this special core setting fixture.

Why production men choose I-R Air Hoists

There are 58 sizes available. Lifting capacities range from 200 lbs. to 20,000 lbs.

POINTS OF SUPERIORITY

- VARIABLE SPEED—Lifting power ranges from a smooth creep to full speed.
- OVERLOAD FACTOR—Air motors cannot be damaged by overloading. More horsepower per pound of weight.
- SMOOTH CONTROL—A single rotary valve eliminates jerks and provides the exceptionally smooth power.
- AUTOMATIC BRAKE—A positive brake holds the load even though the air supply should fail.
- POPPET TYPE THROTTLE VALVE—Prevents air leakage when the hoist is idle.
- SPOOL DRUMS—Furnished in place of grooved drums where extra lift is desired.
- LOW MAINTENANCE—I-R hoists are universally recognized for their reliability and low maintenance.



PENDENT THROTTLE

The only complete line of

air hoists with convenient

'one-hand" control

provides "Finger-tip" control over full range of speeds



Ingersoll-Rand



MACHINERY, May, 1953-335



CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester B. N. Y.
Rochester B. N.
Roch

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Atrax Co., Newington, Conn.
Barber-Collman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850
Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237,
Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland, Ohio.
Douglas Tool Co., 2300 E. Nine Mile Rd., Hazel
Park, Mich.
E32, Mich.
E32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Galring Tool Co., 21225 Hoover Rd., Detroit
32, Milch.
St., Mich.
Moodraw, Wilson burgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroing 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, III. Illinois Tool Works, 2001 North Neeler Cve., Chicago, Ill.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass. Morse I Wist Drill a Mch. Co., 1969 Destroy, Mass. National Tool Co., 11200 Madison Ave., Cleve-land, Ohio. National Twist Drill & Tl. Co., Rochester, Mich. OK Tool Co., Milford, N. H. Onsrud Machine Works, Inc., 3940 Palmer St., Chicago. Ill. Onsrug most control of the Chicago, III. Chicago, III. Pratt & Whitney, West Hartford 1, Conn. Super Tool Co., 21650 Hoover Rd., Detroit 13, Pratt & Whitney, West Hartford 1, Conn. Super Tool Co., 21650 Hoover Rd., Defroit 13, Mich. Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio. Tomkins-Johnson Co., Jackson, Mich. Union Twist Drill Co., Athol, Mass. Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich. Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files and Burs, Rotary.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

CUTTING AND GRINDING FLUIDS

Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23 ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brewn & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 5. Water St., Jackson, Mich. (Lathe Type for Tubing).
Pines Engineering Co., Inc., Aurora, III.

(Continued on page 338)

If you tap or drill small parts

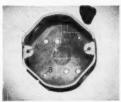
you can't afford to be without - Etter Emrick

UNIT-ENGINEERED" MULTIPLE HEADS

To put your small parts tapping and drilling on a low-cost, mass production basis you need specially engineered methods and equipment. Ettco's years of specialization in this field has led to the development and refinement of the Ettco-Emrick "Unit-Engineered" Multiple Head System, which is one of today's fastest, most economical methods of tapping and drilling small parts. Here's what it provides -

- Multiple head and work holder engineered as a unit for your specific part to insure fastest handling and production with each stroke of the drill press.
- A selection of dozens of different standardized methods of handling a wide variety of shapes and sizes of parts and number and spacing of
- Interchangeable tapping and drilling face plates to permit quick, easy changeovers from tapping to drilling — a patented Ettco-Emrick feature.
- A design that assures quick, easy installation on any make or model drill press.
- A limitless variety of spindle arrangements with capacities ranging from wire sizes to 3/8" in steel.

D JOBS LIKE THESE FASTER, EASIER, AT LESS COST



Steel outlet box with 4 tapped holes. Production—12,800 tapped holes per hour with dual multiple head unit.



54 holes drilled and countersunk in one operation with a multiple head and electric indexing



Die casting with 6 holes - 3 in each of two planes — automati-cally positioned and tapped in one operation.

If your small parts production calls for multiple drilling, reaming, countersinking, tapping or threading — it will pay you to check with Ettco. Call in your nearest Ettco-Emrick distributor or send us a sample or drawing for recommendations and estimates.

FOR DETAILS, WRITE FOR **BULLETIN No. 3**



ETTCO TOOL CO., INC. 592 Johnson Ave., Brooklyn 37, N. Y.

DETROIT . CHICAGO . WORCESTER . SAN GABRIEL, CALIF. Dealers throughout the United States and Canada

DRILLING and TAPPING **EQUIPMENT NEWS**

Tapping Machines Boost Multiple Head Output



Ettco-Emrick tapping machines are designed for automatic or semi-automatic operation with multiple spindle drilling or tapping heads and single spindle tapping attachments. The No. 72A machine is foot or air-operated. The No. 74 machine is air operated and electrically controlled. Details in Bulletins No. 72A and No. 74. Write Etteo Tool Co., 592 Johnson Avenue, Brooklyn 37, N. Y.

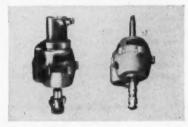
Electric Indexing Fixture Has Fast, Precise Action



Etteo-Emrick Indexing Fixtures provide smooth. shockless, positive action. Can be used on any machine base. Synchroniza-

tion of index fixture with outside machine member is electrically controlled. Utilizes interchangeable nesting plates ranging from 10" to 14" in diameter. Details in Bulletin No. 97. Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn 37. N. Y.

Tool Up Any Drill Press For Fast, Accurate Tapping



Ettco-Emrick tapping attachments can be mounted on any drill press. Newly patented friction clutch provides the delicate sensitivity needed for high speed tapping or threading. 7 different models for No. 6 to %" dies and for No. 0 to 1" taps. Details in Bulletin No. 22. Write Ettco Tool Co., 592 Johnson Ave., Brooklyn 37, N.Y.

MACHINERY, May, 1953-337



* Full Diameter Range to Capacity

* Simple Precision Matching . . .



Reed attachments have two opposed rolls which pass over the work when rolling the thread. They are easy to set up and rolls may be quickly changed and adjusted for size. A simple device provides for precise matching of the rolls.

Thread rolling is accepted as an economical and preferred method of producing smooth precision threads on automatic screw machines and turret lathes at high production rates. It permits threading close to shoulders and since rolling can be done on the collet end of the part behind shoulders, a secondary threading operation is often eliminated.

The series G2A Reed Thread Rolling Attachments are multi-purpose tools currently built in four popular standard sizes. Each attachment will accommodate an unlimited range of diameters within its capacity—only a single attachment is required for rolling all diameters within the size range. Straight or taper threads may be accurately rolled whether they are right or left hand or have multiple leads.

Send us specifications of your requirements and let us supply you with complete information.

REED ROLLED THREAD DIE CO.

THREAD ROLLING MACHINES and DIES • KNURLS • THREAD ROLLS
Wercester, Massachusetts, U.S.A.

Sales Offices In: Buffalo, Chicago, Cleveland, Compton, Calif., Detroit, Englewood, N. J., Houston Indianapolis, Milwaukee, Montreal, New York City, Philadelphia, Pittsburgh, St. Louis, Syracuse, Toronto

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CUTTING-OFF MACHINES, Cold Saw

See Sawing Machines, Circular.

CUTTING-OFF MACHINES, Metal Band Saws

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DOAII Co., 254 Laurel Ave., Des Plaines, III.
Famco Machine Co., 3134 Sheridan Rd.,
Kenosha, Wis.
Grob Bros., Grafton, Wis.

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Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, IiI.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth, Mc., Plymouth, Mich.

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Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
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Tomkins-Johnson Co., Jackson, Mich.

DEALERS, Machinery

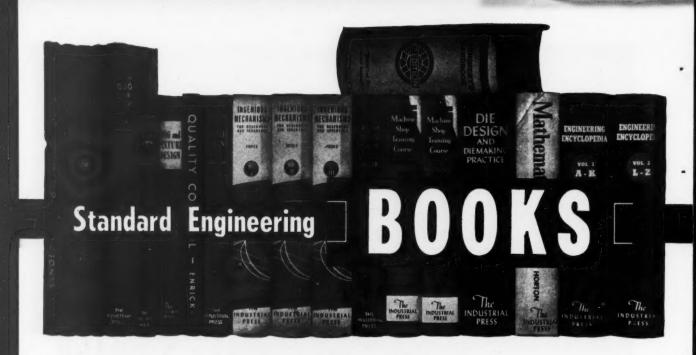
Botwinik Bros. of Mass., Inc., 14 Sherman St., Worcester, Mass. (Continued on page 342)



Quick-As-Wink Control Valves

Hand, Foot, Cam, Diaphragm and Solenoid Operated

Mfd. by C. B. HUNT & SON, INC., 1911 East Pershing St., Salem, Ohio



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Since its first edition, almost a million copies of this invaluable reference book have been sold. The 14th edition of this world-renowned book contains the latest and most useful machine-designing and machine-shop data available—the kind of information that is needed by everyone who designs or builds machines, tools or mechanical devices. Changes in standards and practices often make old handbooks unsafe to use. Be sure you have the latest information on new or revised standards, as well as complete mechanical and mathematical tables, rules, formulas, and general data—all contained in one handy volume. 1911 Pages. \$8.00 postpaid in U. S. Canadian or foreign postage, 75\$.

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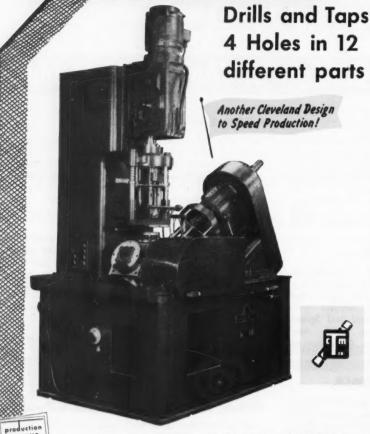
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of this Guide

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With the precision lead screw feed more perfect pieces per hour are possible on Cleveland machines. By com-bining several operations in one machine and tapping groups of holes at one stroke Cleveland engineers are able to realize greater speed with proportionately lower operating costs.

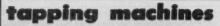
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CANTON 6, OHIO

For Better Tapping -- Faster!



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Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
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Sheffield Corp., 721 Springfield, Dayten, Ohie. Sundstrand Mch. Tool Co., 2531 11th St., Rockford, III.

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See Castings, Die.

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Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
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Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

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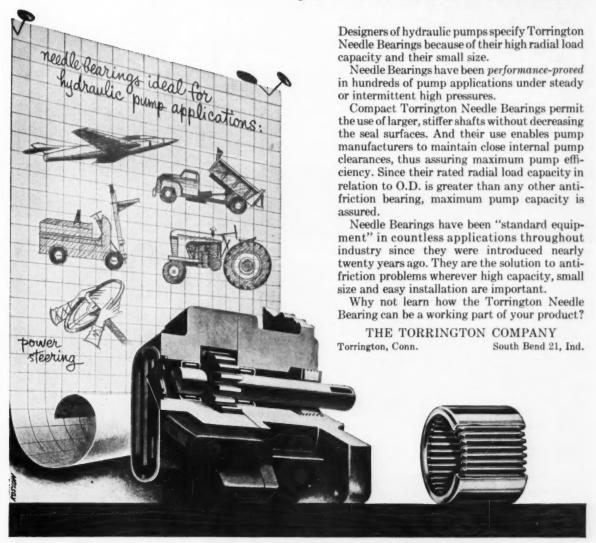
Grab Bros, Grafton, Wls.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Maumee St.,
Adrian, Mich.
Precise Products Corp., 1328-30 Clark St.,
Racine, Wis.

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GEROTOR









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PRODUCTION

PROBLEM: Build progressive dies combined with dial operation to produce a series of intricate ball bearing seals. Seals consisted of a formed metal ring and neoprene insert assembled into a single unit. All assemblies had to be identical, meet micro-tolerant specifications.

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50,000 ball bearing seals were run for customer's actual assembly line use. Here guesswork, error, costly adjust-ments were eliminated — here was visual evidence that the die must work in the customer's equipment to his unqualified satisfaction before it was certified "PRODUCTION PROVED" and shipped.



Ball bearing die during pre-test run on customers' equipment. First step of exhaustive tests before die is certified "PRODUCTION PROVED."

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DIES, Lettering and Embossing

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Bliss, E. W., Co., 1375 Raff Rd., S. W, Canton, Ohio
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Dreis & Krump Mfg. Co., 7416 Loornis Blvd., Chicago 36, III.
Ferracute Mch. Co., Bridgeton, N. J.
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Metal Carbides Corp., Youngstown, Ohio.
Mullins Manufacturing Corp., Salem, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
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Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, III.
Waltham, Mch. Wks., Newton St., Waltham, Mass.

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Ohio

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DIES, Threading, Opening

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Sheffield Corp., 721 Springfield, Dayton, Ohio. (Continued on page 348)

ACCO products

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New... Low Cost

No. 223 Wet Abrasive Cutting Machine

Fast, clean, close tolerance cuts of hardest alloys and all other metals. Won't work-harden material.

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CAMPBELL

Abrasive Cutters and Nibblers

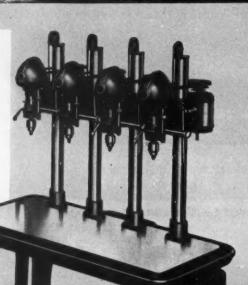
MACHINERY, May, 1953-345

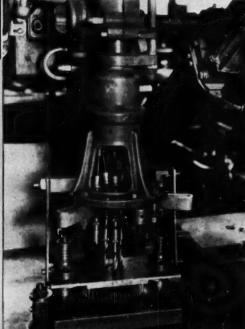
Our Production Jumped





DELTA
QUALITY
MAKES THE
DIFFERENCE





300% with our first

DELTA Drill Press

says CHARLES LASLO, Superintendent, CLOYES GEAR WORKS, Cleveland, Ohio

4-spindle 14" drill press drills 4 to 6 holes at one time in timing gears—Chamfering is free operation—Machine used 30-40 hours per week, maintenance negligible.

 Another example of improved direct labor efficiency by using DELTA tools

"In our pre-Delta era," says Mr. Laslo, "we used a 4-spindle drilling machine with flat-belt drive to drill and chamfer holes in timing gears used by leading auto builders. Belt slippage lost a lot of production and belt maintenance was high. Pieces were held by hand, and precision tolerances were hard to maintain.

"We bought a Delta 4-spindle, 14" drill press to do the combined drilling and chamfering operation on the gears. The No. 1 spindle was equipped with a fixture to hold the work, a multiple spindle head to do all the drilling, and a power feed.

"Chamfering became a 'free' operation because, while the No. 1 spindle goes through its automatic cycle, the operator chamfers the already-drilled piece from the previous cycle, puts it in the finished stock box, and gets a new piece ready.

"These operations are absolutely cost-free from a labor standpoint—compared with the old method.

"Also when time studies on one product proved that handling operations accounted for $\frac{1}{3}$ of

total cost, we installed another Delta singlespindle 14" drill press mounted on a wheelequipped table. By moving the tool we eliminated most of the moving of the work.

"Recently, to deal with heavier volume we bought a Delta 17" drill press that drills 1/16" and 27/64" holes with extraordinary efficiency and accuracy."

Results speak for themselves:

- Quality greatly improved—fewer rejects
- Operations eliminated
- Production quadrupled

Thousands of other Delta users are getting the same labor savings from multiple set ups that include the Delta 17" power feed drill press.

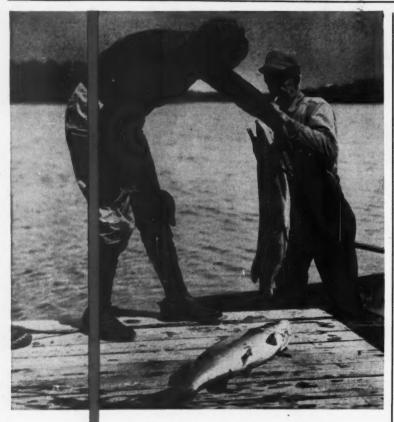
Can you win new "highs" in volume and quality?
—most likely, yes! It's surely worth a little nocost exploration. Talk to your Delta dealer—
listed in the classified pages of your phone book
under "Tools" or "Machinery"; and use the
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Another Product of Rockwell



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Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
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Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, III.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAFTING MACHINES

Universal Drafting Mch. Corp., 7960 Lorain Ave., Cleveland, Ohio.

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Erickson Tools, Div. Erickson Steel Co., 2309
Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio Meyers, W. F., Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
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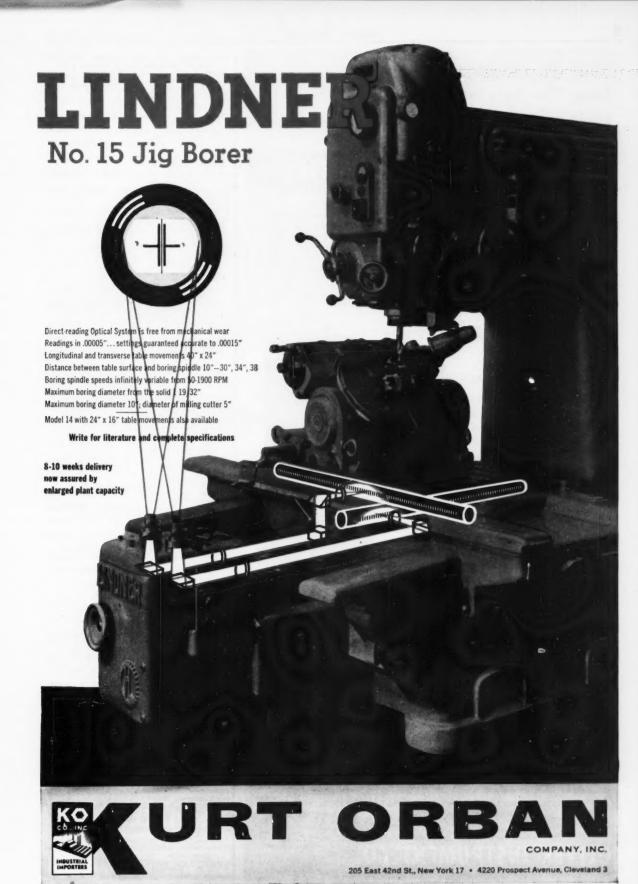
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario 5t. Chicago, III.
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Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Buffalo Forge Co., 490 Broadway, Buffalo,
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Delta Power Tool Div., Rockwell Mfg. Co.,
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Errington Mechanical Laboratory, 24 Norwood
Ave., Stapleton, S. I., N. Y.
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Govro-Nelson Co., 1933 Antoinette St., Detroit
8, Mich.
Moline Tool Co., 102 20th St., Moline, III.
Thriftmaster Products Corp., 1076 N. Plum St.,
Lancaster, Products Corp., 1076 N. Plum St.,
Linited States Drill Head Co., 616 Burns,
Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Beaver Tool & Engineering Corp., 2850
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(Continued on page 350)



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Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist- Drill Co., Athol, Mass.
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Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave.,
Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry Co., 287 Homestead
St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive,
Menlo Park, Calif.
Milholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-M Harriet
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National Automatic Tool Co., Inc., 5, 7th and
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Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale
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Zagar Tool, Inc., 24000 Lakeland Blvd., Cleve-20, Mich. Zagar Tool, Inc., 24000 Lakeland Blvd., Cleve-land 23, Ohio.

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Delta Power Tool Div., Rockwell Mfg. Co.,
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Dumore Co., 1300 17th St., Racine, Wis.
Famco Machine Co., 3134 Sheridan Rd.,
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Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
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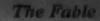
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio. Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.

DRILLING MACHINES, Deep Hole

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The fable of The Three Brothers

HOLDS A LESSON
FOR CUTTING FLUID USERS



THREE brothers inherited equal shares of their father's farm. One brother feverishly worked his land, with seldom a rest, until prematurely worn out, he died at an early age. The second brother loafed and played until his land went to ruin and he died for want of food. The third brother, wiser than the other two, balanced his work and play, so that he prospered mightily and lived to a ripe old age.

The Lesson

BALANCING cutting fluids produces best results, too. The proper balance of chemical activity will provide the longest possible tool life consistent with surface finish desired.

Figure 1 shows abnormal front clearance wear of a single point tool due to excessive chemical activity of the cutting fluid used. The tool failed prematurely, just like the first brother in the fable.

Figure 2 shows abnormal cratering of a tool due to *insufficient* chemical activity of the cutting fluid used. Such cratering is usually associated with poor surface finish. This tool failed prematurely like the indolent brother in the fable.

Both of the above examples of tool failure were developed under identical conditions, except for the degree of chemical activity of the cutting fluids used.

The proper balance of chemical activity gives the most profitable results. For the right cutting fluids for your work, ask to have your Stuart Oil Representative call. Use the handy coupon below.



FIG. 1—Abnormal front clearance wear caused by excessive chemical activity of cutting fluid.



FIG. 2—Cratering of cutting tool, usually associated with poor finish, resulting from insufficient chemical activity of cutting fluid used.

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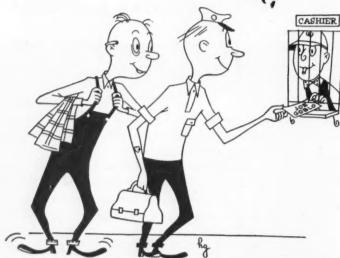
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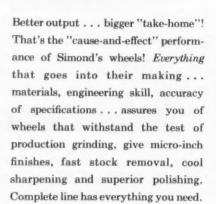
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Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
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Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.

(Continued on page 354)

Why you can lower inspection costs with a Kodak Conju-Gage Gear Checker

Why the composite check

The composite check recommended in American Standard B6.11-1951 tests gears functionally by running the gear against a master of known accuracy. The resulting displacement shows at once the cumulative effect of as many as six types of error—eliminates time-consuming checks for each individual error. The check is rapid and conclusive.

Why the Kodak Conju-Gage Gear Checker

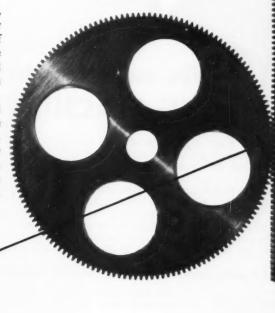
To meet today's tolerance requirements, the Kodak Conju-Gage Gear Checker uses a master made with a new order of precision. This is the Kodak Conju-Gage Worm Section, produced by thread grinding under control of a precision lead screw.

The accuracy inherent in this method means every right gear is passed by the worm section, reducing rejection losses. The transverse curvature produced by this method provides a master that can be used to check any gear of like pitch and pressure angle, regardless of helix.

Not only can a single worm section be used in place of a number of circular masters, but such a worm section can be reground to specification as often as necessary—at a fraction of replacement cost. It is easily checked for accuracy by familiar toolroom procedures.

You can find out more about the economies possible through Kodak Conju-Gage Instrumentation by sending for a copy of the booklet, "Kodak Conju-Gage Gear Testing Principle." Write to:

> Industrial Optical Division EASTMAN KODAK COMPANY Rochester 4, N. Y.



The Kodak Conju-Gage Gear Checker automatically records the composite effects of runout, base pitch error, tooth thickness variations, profile error, lead error, and lateral runout. Illustrated is the Kodak Conju-Gage Gear Checker, Model 4U, for gears up to 4½" pitch diameter. Larger and smaller models are also available.

CONJU-GAGE



INSTRUMENTATION

... a new way to check gear precision in action

To inspect all kinds of complex parts on a bright screen, Kodak also makes two highly versatile contour projectors.

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Save Labor



Wire and Ribbon Metal FORMING MACHINES

Mounting production costs are driving firms out of the competitive picture. Too much scrap metal! Too many single operation machines! Too many operators! This whole picture can be changed to a highly profitable operation.

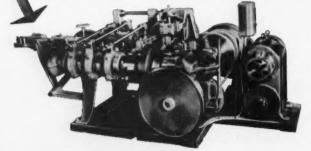
Install a NILSON combination press and 4-Slide forming machine. This machine takes wire or ribbon metal directly from the coil, straightens, feeds, pierces, blanks, swages, stamps, or coins, cuts off and forms . . . automatically in one quick precise operation. See the new picture? . . . Increased production! Minimum scrap metal! One machine for all operations! One operator!

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NILSON has been specializing in Forming Equipment for over 50 years.

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Moline Tool Co., 102 20th St., Moline, III.
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National Automatic Tool Co., Inc., 5. 7th and
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Prott & Whitney, West Hartford 1, Conn.
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See Drilling Machines, Gang.

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Famco Machine Co., 3134 Sheridan Rd.,
Kenosha, Wis.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland
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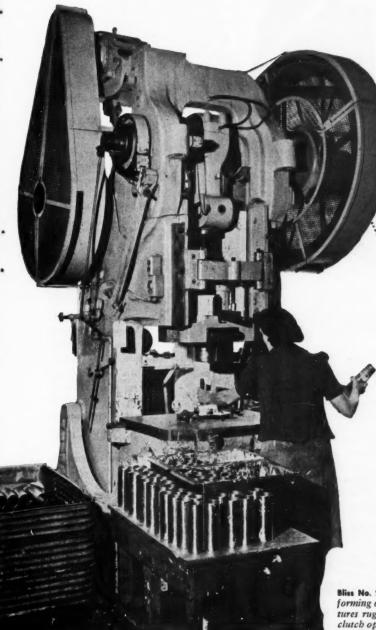
Kenosha, Wis.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760
Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
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Delta Power Tool Div., Rockwell Mfg. Co.,
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(Continued on page 356)

THE TREND IS TO MORE STAMPINGS WITH BLASS PRESSES





Not a dime spent on maintenance in 8 years in Signal ALL-BLISS press shop

Snyder Manufacturing Co. of Philadelphia discarded all their old presses and equipped their shop 100% with Bliss inclinable and straight-side presses back in 1945.

That was a significant decision for the world's largest manufacturer of television and auto radio aerials.

Results? In the eight years that Snyder's press shop has been all-Bliss, they have not had to spend a *single* dime on maintenance of the 25 Bliss presses.

And, as the press room accident rate dropped to zero with the Bliss presses, operators found they could run the presses faster.

The Snyder story is not unique. Bliss is the dominant factor in press room after press room. For a complete press room or a single press for a given job, you'll find it's best to call in Bliss.

Bliss No. 23 Inclinable Press, used by Snyder for forming operations on television accessories, features rugged construction, fast and dependable clutch operation.

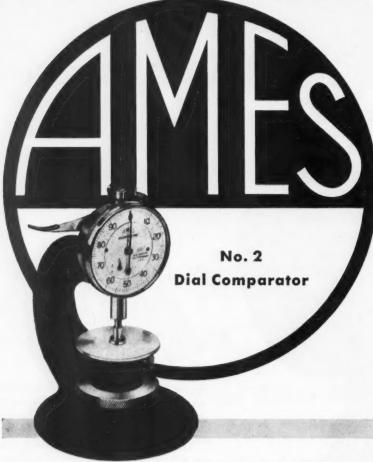
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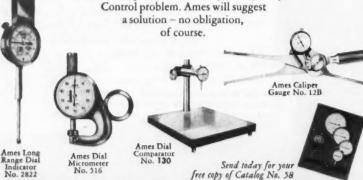
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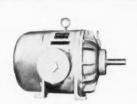
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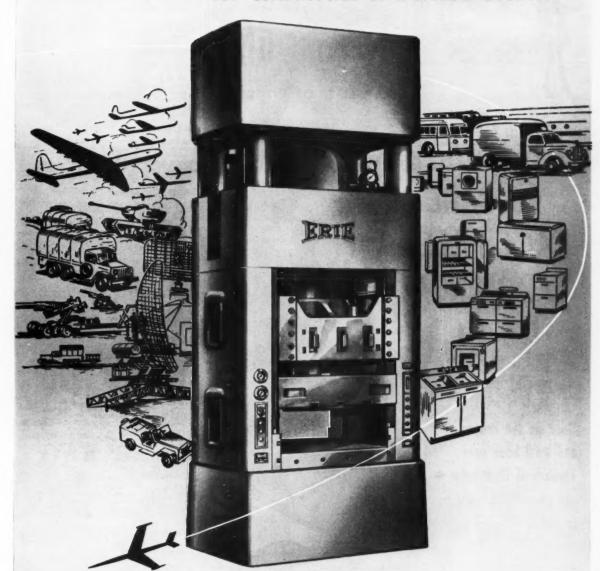
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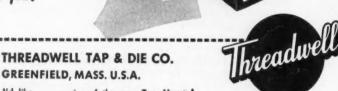
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(Continued on page 366)



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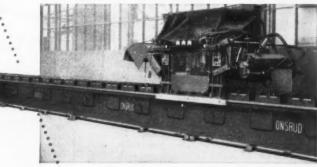
precision parts to the huge structural plate members of wings and fuselage...removing colossal quantities of metal at fantastic production speeds. Onsrud machine design principles, now proved by almost twenty years of application are the key to the fastest production in nonferrous milling... for the aircraft industry, and all other fields of nonferrous metalworking. Typical Onsrud machines are shown here.



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Starrett, The L. S., Co., Athol, Mass.

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Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co.,
Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon
Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Morse Twist Drill & Mch. Co., New Bedford,
Mass.

Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette 5t.,
New York 12, N. Y.

Sheffield Corp., 721 Springfield, Dayton, Ohio. Standard Gage Co., Inc., Poughkeepsie, N. Y. Starrett, The L. S., Co., Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I. Turner Bros, Inc., 2625 Hilton Rd., Ferndale 20, Mich.

Van Keuren Co., 176 Waltham St., Watertown, Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.

Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich. Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

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GAGES, Surtace

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Brown & Sharpe Mfg. Co., Providence, R. I.

Columbus Die-Tool & Mch. Co., 955 Cleveland
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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.

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Starrett, The L. S., Co., Athol, Mass.

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Engis Equipment Co., 431 S. Dearborn St.
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Pratt & Whitney, West Hartford I, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
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Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co.,
Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohlo.
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Modern Industrial Engineering Co., 14228 Birwood, Detroit 4, Mich.

Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

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AND EQUIPMENT

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GEAR CUTTING MACHINES, Spur and **Bevel Gears (Rotary Cutter)**

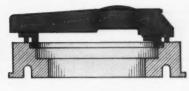
Waltham Machine Works, Newton St., Wal-tham, Mass. (Continued on page 368)



Here's the Answer SHALLOW

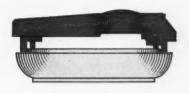


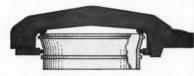
either INSIDE



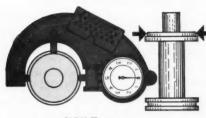


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Humped Types Inside or Outside



"C" Types Inside or Outside



Checking the accuracy of a diameter on a shallow shoulder or similar section is often a problem, especially if the diameter is large in comparison with the surface being measured. (See sketches.) With these Shallow Diameter Gages, however, it's easy to get fast, accurate checks.

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Farrel-Birmingham Co., Inc., 25 Main St.,
Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester
3, N. Y.
Michigan Tool Co., 7171 E. McNlichols Rd.,
Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean
Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave.
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Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.

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Atlantic Gear Works, Inc., 200 Latayette St.,
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Automotir.—Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave.,
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Bilgram Gear & Mch. Works, 1217-35 Spring
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Boston Gear Works, 3200 Main St., North
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Brad Foote Gear Works, 1309 S. Cicero Ave.,
Cicero 50, III.
Braun Gear Co., 239 Richmond, Brooklyn 8,
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Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St.,
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Cone-Drive Gears Div., Michigan Tool Co.,
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Gear Specialties, Inc., 2635 W. Medill Ave.,
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Gleason Works, 1000 University Ave., Rochester
3, N. Y.
Greoves Mch. Tool Co., 2009 Eastern Ave.,
Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead
St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez
Ave., Chicago 35, III.
(Continued on page 370)





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Westinghouse Electric Corp., Pittsburgh 30, Pa
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Boston Gear Works, 3200 Main St., North
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Sinclair Refining Co., 630 5th Ave., New
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Sun Oil Co., 1608 Walnut St., Philadelphia,
Pa.
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GRINDERS, Carbide Tool

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
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Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orbon, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
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(Continued on page 372) (Continued on page 372)



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Mummert-Dixon Co., Hanover, Pa.

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Dumore Co., 1300 17th St., Racine, Wis.
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Walls Sales Corp., 333 Nassau Ave., BrookIyn 22, N. Y.

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35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th
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900 North Ave., Plainfield, N. J.

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GRINDING MACHINES, Comshaft

Landis Tool Co., Waynesboro, Pa. Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

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Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
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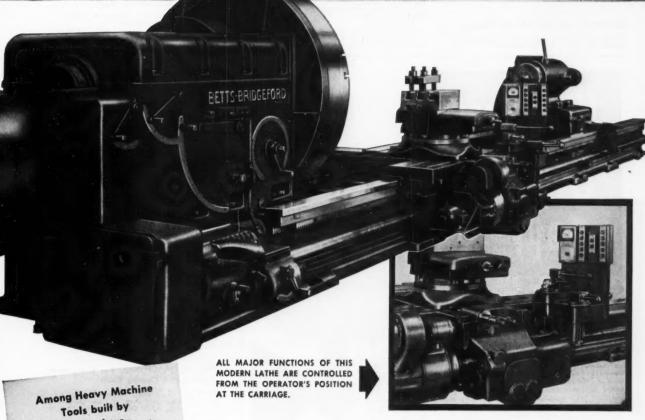
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- · Altogether, this modern lathe embodies the advanced features necessary to meet today's demand by industry for high production with greater accuracy and durability. Full information on this lathe or other Betts-Bridgeford Heavy Duty Lathes from 26" to 144" and larger will be furnished upon request.

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Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester S, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnoti Grinders, Inc., Cincinnoti, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17,
N. Y.
DoAll Co., 254 Lourel Ave., Des Plaines, III.
Dumore Co., 1300 17th St., Racine, Wis.
Frauenthal Div., Kaydon Engineering Corp.,
Muskegon, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6,
Mass.
Bivett Latte & Grinder, Inc., Brighton, Baston

Mass. Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass. Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Die Choser

Eastern Mch. Screw Corp., New Haven, Conn. Landis Machine Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besly-Welles Corp., Beloit, Wis Gardner Machine Co., 414 k. Gardner St., Beloit, Wis. Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich. Mattison Machine Works, Rockford, III. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Drill

Blake, Edward, Co., 442 Cherry St., West Newton 65, Mass.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 É. Maumee St., Adrian. Mich. Douglas Ave., Ratamazo 30.

Oliver Instrument Co., T410 E. Maumee St.,
Adrian, Mich.

Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York 17, N. Y.

Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

N. Y.
Mattison Machine Works, Rockford, III.
Oliver Instrument Co., 1410 E. Maumee St.,
Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment.

GRINDING MACHINES, Gop

Cincinnati Grinders, Inc., Cincinnati, Ohio. Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Goar Tooth

See Gear Grinding Machines.

GRINDING MACHINES, For Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co., Rock and Montague, Rock-Barber-Colman Cc., Rock and Montague, Nock-ford, III. British Industries Corp., 164 Duane St., New York, N. Y. Brown & Sharpe Mfg. Co., Providence, R. I. Cincinnati Milling Mch. Co., Cincinnati, Ohio. Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave.,
S. W. Grand Rapids 4, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St.,
Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6,
Mass.
Oliver Instrument Co., 1410 E. Maumee St.,
Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St.,
Chicago, Ill.
Prott & Wiltney West Hartford I. Conn.

Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, III. Prott & Whitney, West Hartford 1, Conn. Precise Products Corp., 1328-30 Clark St., Rocine, Wis. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio. Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio. Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

Delta Power Tool Div., Rockwell J. J. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Ex-Cell-O Corp., 1200 Oakman Bivd., Detroit 32, Mich. 2. Mich.

Hammond Machinery Builders, Inc., 1600
Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St.,
Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York 17, N. Y.
South Bend, Lathe Works, Inc., 425 E. Madison
St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River
Rd., Cincinnati 4, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.,
Arter Grinding Mch. Co., 15 Sagamore Rd.,
Worcester S, Mass.
Bryant Chucking Grinder Co., 257 Clinton St.,
Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17,
N. Y. P., 1200 170 51 Cosa Corp., 405 Lexington Ave., Isew Total., N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Frouenthal Div., Kaydon Engineering Corp.,
Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Neise, Karl A., Dept. M., 381 Fourth Ave.,
New York 16, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St.,
Racine, Wis. (Continued on page 376)

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Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio. Wicaco Machine Corp., Stenton Ave. and Lou-den St., Philadelphia, Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn. Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear

Abrasive Mch. Tool Co., Dexter Rd., E. Provi-dence 14, R. I. Hill Acme Co., 1201 W. 65th St., Cleveland 2, Mattison Machine Works, Rockford, III.

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., Beloit, Wis. Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. Heald Machine Co., 10 New Bond St., Wor-Heald Machine Co., 10 New Bond St., Wor-cester 6, Mass. Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo. Mattison Machine Works, Rockford, III. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnat i4, Ohio.

GRINDING MACHINES, Profile

Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland 12, Ohio. Cosa Corp., 405 Lexington Ave., New York 17, N. Y. N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Rodial, Ball Race, Etc.

Besly-Welles Corp., Beloit, Wis. Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich. Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Radius, Link

Consolidated Mch. Tool Corp., Rochester, N. Y. Sundstrand Mch. Tool Co., 2531 11th St., Rockford, III.

GRINDING MACHINES, Ring Wheel

Besly-Welles Corp., Beloit, Wis. Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. Mattison Machine Works, Rockford, Ill. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Farrel-Birmingham Co., 25 Main St., Ansonia, Conn. Landis Tool Co., Waynesboro, Pa. Norton Co., 1 New Bond St., Worcester 6,

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I. Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.

Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.

British Industries Corp., International Machinery Div., 164 Duane St., New York, N. Y. Brown & Sharpe Mfg. Co., Providence, R. I.

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. DoAll Co., 254 Laurel Ave., Des Plaines, III. Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.

Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.

Gardner Machine Co., 414 E. Gardner St., Belait, Wis. Heald Machine Co., 10 New Bond St., Wor-cester 6, Mass.

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

Mattison Machine Works, Rockford, III. Norton Co., 1 New Bond St., Worcester 6, Mass.

Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

Pratt & Whitney, West Hartford 1, Conn. Reid Bros. Co., Inc., Beverly, Mass. Sheffield Corp., 721 Springfield, Dayton, Ohio. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

Taft-Peirce Mfg. Co., Woonsocket, R. I. Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Top

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Dumore Co., 1300 17th St., Racine, Wis. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit

32, Mich.

Jones & Lamson Mch. Co., 160 Clinton St.,
Springfield, Vt.

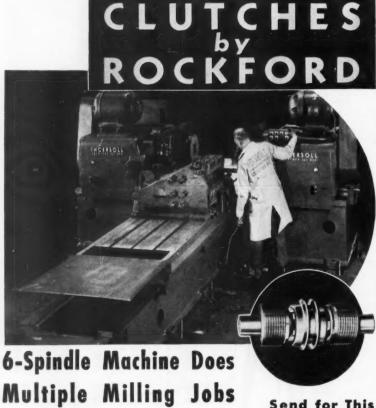
Landis Machine Co. (Centerless), Waynesboro,

Landis Tool Co. (Centerless), Waynesboro, Pa. Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y. Precise Products Corp., 1328-30 Clark St., Racine, Wis. Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I. Cincinnati Grinders, Inc., Cincinnati, Ohio. Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.

(Continued on page 378)



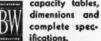
INGERSOLL Milling Machine Company designs and builds special machines to meet customer requirements. By accepting responsibility for performance and guaranteeing production rates and accuracy, INGERSOLL assures customer satisfaction. ROCKFORD CLUTCHES help assure dependable performance. Let ROCKFORD cluth engineers help your designers specify reliable power transmission controls for your machines.

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Shows typical installations of ROCKFORD

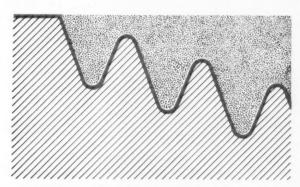


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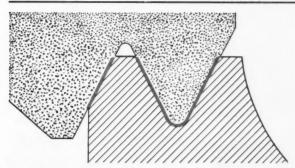
Key to Accurate, Fast Contour Grinding . . . A HOGLUND Automatic or Manual Dresser



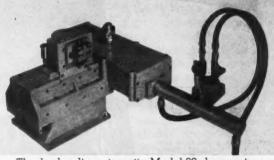
Pine-tree form at base of jet-engine bucket has a combination of convex and concave surfaces difficult to put into a grinding wheel—without the Hoglund Model-7B Dresser.



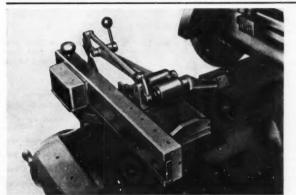
Automatic and electric-motor powered, the Model 7-B eliminates all skill in dressing. Two circular cams move the diamond across and into the wheel, providing a very compact unit. It is being used on the Thompson double-wheel bucket and blade grinder.



Compressor-blade root form has extremely close tolerances. A Model-32 Hoglund Dresser mounted on a Thompson Surface Grinder provided the high degree of accuracy and perfect blending of radius and tangent needed.



The hydraulic automatic Model-32 dresses in one continuous, smooth movement across the wheel. Diamond movement is reduced from the magnified contour template by inclined planes—there is **no** pantagraph linkage.



Three-inch-wide wheels can be handled by our newest model, the KB11-3 manual dresser. It will fit on any horizontal surface grinder—and will dress any contour, no matter how complex, that can be entered by the diamond.

We make over 40 models, both special and regular, for surface, cylindrical and gear grinding machines. They all share four common features: (1) Pantograph linkage eliminated, usually by inclined planes. (2) Wheel dressed in one continuous operation. (3) Compactness and light weight. (4) A microscope fixture for precise setting of the diamonds in their holders.

Send us your blueprints and have us submit our recommendations.

HOGLUND

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Berkeley Heights New Jersey

Landis Tool Co., Waynesboro, Pa. Norton Co., 1 New Bond St., Worcester 6, Mass. Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

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Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt. Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y. Bay State Abrasive Products Co., Westboro, Mass. Besly-Welles Corp., Beloit, Wis. Blanchard Machine Co., 64 State St., Cambridge, Mass. Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.

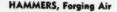
Cincinnati Milling Machine Co., Grinding Wheels Div., Cincinnati, Ohio.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Norton Co., I New Bond St., Worcester 6, Mass.
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill. (Diamond).
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio. Chambersburg Engra. Co., Chambersburg, Pa. Erie Foundry Co., Erie, Pa. Morgan Engra. Co., Alliance, Ohio.



Chambersburg Engrg. Co., Chambersburg, Pa. Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa. Chicago Preumotic Tool Co., 6 E. 44th St., New York, N. Y. Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas. Ingersoll-Rand Co., Phillipsburg, N. J. Keller Tool Co., Grand Haven, Mich.

HAMMERS, Portable Electric

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md. Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa. Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Shaft

S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa. Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.

HAMMERS, Steam

Chambersburg Engrg. Co., Chambersburg, Pa. Erie Foundry Co., Erie, Pa.

HARDENING EQUIPMENT

Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flome

Cincinnati Milling Machine Co., Cincinnati,

HARDENING, Surface

Electrolizing Corp., 1505 East End Ave., Chicago Heights, III.

HARDNESS TESTING INSTRUMENTS

Ames Precision Mch. Wks., Waltham, Mass. Shore Instrument & Mfg. Co., Van Wyck Ave. and Carll St., Jamaica, N. Y. Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES

National Machinery Co., Greenfield and Stan-ton Sts., Tiffin, Ohio.

HEAT-TREATING EQUIPMENT

Ipsen Industries, Inc., 536 N. Madison, Rockford, III.

HOBBING MACHINES

See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS

Barber-Colman Co., Rock and Montague, Rock-Barber-Colman Co., Rock and Montague, Rockford, III.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co.,
Hartford, Conn.
Illinois Tool Works, 2501 North Keeler Ave.,
Chicago, III.
Michigan Tool Co., 7171 E. McNichols Rd.,
Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester,
Mich. Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut
Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS

Bethlehem Steel Co., Bethlehem, Pa. (Continued on page 380)



Specially designed for short and medium run jobs, a single Millholland Automatic Boring Unit can be used for a variety of jobs, and one or more units can be mounted on a bed to perform a wide range of operations. Automatic operation replaces manual lever shifts, giving a complete automatic feed cycle. Hydraulic feeds are infinitely adjustable.

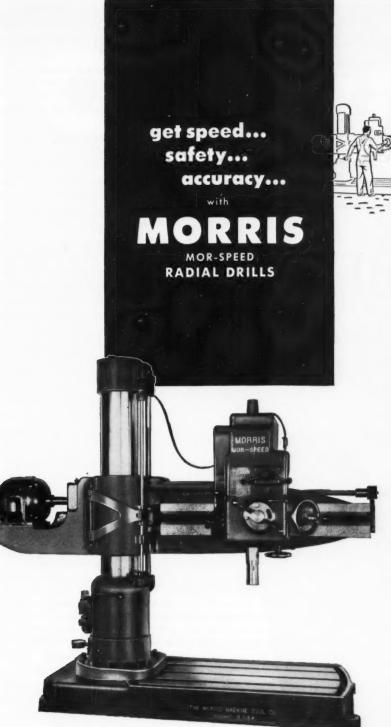
The body is heavily proportioned throughout for maximum rigidity. The hardened steel alloy spindle reciprocates thru hardened steel bushings mounted in the sleeve. The sleeve is contained in two precision Timken bearings.

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W. K. MILLHOLLAND MACHINERY COMPANY, INC. 6402 WESTFIELD BLVD. INDIANAPOLIS 20, INDIANA



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Duty models with 3 and 4-foot arms.

11-inch Column Heavy Duty models with 3, 4, 5, and 6-foot arms.

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HOISTS, Chain, Etc.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.

HOISTS, Electric

Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

Bornes Drill Co., 814 Chestnut St., Rockford, III.

Carborundum Co., Buffalo Ave., Niagara Falls,

N. Y.
Moline Tool Co., 102 20th St., Moline, III.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co. (Internal & External), 7900
Manchester Ave., St. Louis 17, Mo.

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Barnes Drill Co., 814 Chestnut, Rockford, III.
Barnes, W. F. & John, Co., 201 S. Water St.,
Rockford, III.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, III.
Sunnen Products Co., 7900 Manchester Ave.,
St. Louis 17, Mo.

HONING MACHINES, External

Barnes Drill Co., 814 Chestnut, Rockford, Ill. Micromatic Hone Corp., 8100 Schoolcraft, De-troit 4, Mich.

HONING TOOLS AND FIXTURES

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III.

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Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Birds. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engra. Co., Chambersburg, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus
16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago,
III.

III.

Hanson-Whitney Co., Div. Whitney Chain Co.,
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Hydraulic Press Mfg. Co., 300 Lincoln Ave.,
Mt. Gilead, Ohio.
Lake Frie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd.,
Detroit 12, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4,

Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St.,
Rockford, III.
Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, III.
Vickers, Inc., 1402 Oakman Bivel., Detroit,
Mich.

Walker Hydraulic Duplicator Co., Box 200,

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Rockford, III.
Sx-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, III.
Hadraulic Press Mfg. Co., 300 Lincoln Ave., III.
Hydraulic Press Mfg. Co., 300 Lincoln Ave.,
Mt. Gilead, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston
35, Mass.
Vickers, Inc., 1402 Oakman Blvd., Detroit,
Mich.

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INDEXING AND SPACING EQUIPMENT
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Hartford Special Mchry. Co., 287 Homestead
St., Hartford, Conn.
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Milwaukee 14, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave.,
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Cockford Machine Tool Co., 2500 Kishwaukee
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South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., RockTord, III. Sundstrand Mch. Tool Co., 2531 11th St., Rock-ford, Ill. Taft-Peirce Mfg. Co., Woonsocket, R. I. Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich. Zagar Tool, Inc., 24000 Lakeland Blvd., Cleve-land 23, Ohio.

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Alina Corp., 401 Broadway, New York 13, N.Y. Ames, B. C., Waltham 54, Mass. Brown & Sharpe Mfg. Co., Providence, R. I. DoAll Co., 254 Laurel Ave., Des Plaines, III. (Continued on page 382)



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Mathewson Machine Works, Inc., 28 Hancock St., Quincy 71, Mass.
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Sheffield Corp., 721 Springfield, Dayton, Ohio.
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Taff-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich. Allied Products Corp., 12677 Burt Rd., Detroit

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Hendey Machine Co., Inc., Torrington, Conn. Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.

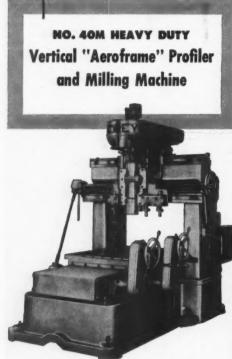
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(Continued on page 384)

(Continued on page 384)



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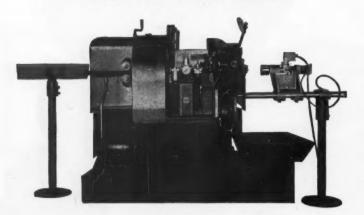
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.

Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

Logan Engra. Co., 4901 W. Lawrence Ave., Chicago 30, Ill.

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(Continued on page 386)

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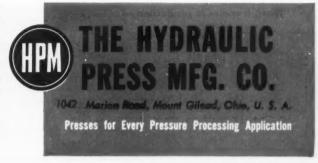
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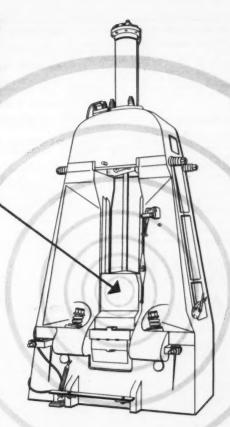
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Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette 5t.,
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Starrett, The L. S., Co., Athol, Mass.
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Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
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Practise Products Corp., 1328-30 Clark St., Rocine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass. Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
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Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
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(Constinued on page 390)

(Continued on page 390)

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MODEL NUMBER	F-10	F-20	F-50	F-80	F-101
RAM SPEED (inmin.) D	own 400 p 800	190 345	120° 240°	73° 151*	130 254
PUMP (gpm.)	3.3	3.3	5*	5*	11
MOTOR (hp)	11/2	11/2	2*	2*	5
STROKE (in.)	6	6	10	10	12
GAP (in.)	10	10	16	16	22
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(Continued on page 392)

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INDEXING



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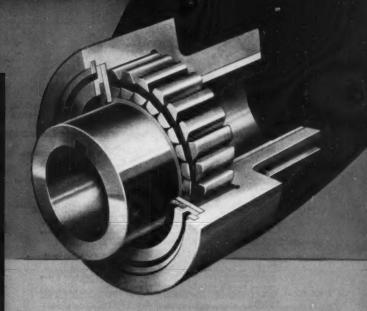
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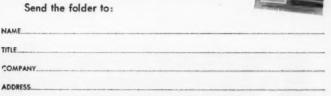


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(Continued on page 394)



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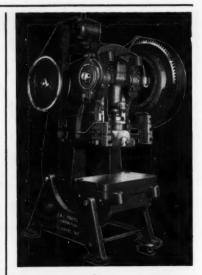
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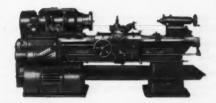
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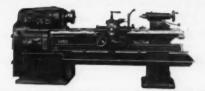
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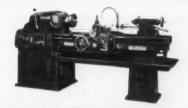
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Chase Brass & Copper Co., Inc., 1949 Rodney
St., Waterbury 20, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave.,
New York, N. Y.

PIPE STEEL

Allegheny Ludium Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center
No. 3 Bldg., Pittsburgh, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York 17, N. Y.
Republic Steel Corp., Republic Bidg., Cleveland
1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th
St., Chicago 18, Ill.
United States Steel Corp., National Tube Co.,
Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES

Landis Machine Co, Inc., Waynesboro, Pa.

PIPE TONGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

PLANER ATTACHMENTS

Consolidated Mch. Tool Corp., Rochester, N. Y. Giddings & Lewis Machine Tool Co., Fond du Loc, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio. Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, III.

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamiiton Corp., Philadelphia 42, Pa. Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate). Corsolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y. Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio. Morton Mfg. Co., Muskegon Heights, Mich. Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, III.

PLASTIC AND PLASTIC PRODUCTS

Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div. Hamilton, Ohio.

Bethlehem Steel Co., Bethlehem, Pa.

Cleveland Punch & Shear Works Co., 3917 St.

Clair Ave., N. E., Cleveland, Ohio.

Consolidated Mch. Tool Corp., Rochester, N. Y.

Ryerson, Joseph T., & Son, Inc., 2558 W. 16th

St., Chicago 18, III.

PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
Brush Electronics Co., 3405 Perkins Ave.,
Cleveland 14, Ohio.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh & Pa.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St.,
Ampere, N. J.
Vinco Corp., 9113 Schaefer Highway, Detroit
28, Mich.

PNEUMATIC EQUIPMENT

Bellows Co., 230 W. Market St., Akron, Ohio. Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St.,
New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton
Ave., Houston 20, Texas.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago,
III. III.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave.,
Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave.,
Chicago 41, III.
Onsrud Machine Works, Inc., 3940 Palmer St.,
Chicago, III.

POLISHING LATHES AND MACHINES

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. Gardner Machine Co. (Div. Landis Tool Co.), 414 E. Gardner St., Beloit, Wis. Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich. Hill Acme Co., 1201 W. 65th St., Cleveland 2, Oblic Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas. Jarvis, Charles L., Co., Middletown, Conn. Precise Products Corp., 1328-30 Clark St., Racine, Wis. Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads.

PRESSES. Air

Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.

PRESSES, Arbor

Bellows Co., 230 W. Market St., Akron, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton
Div., Hamilton, Ohio.
Doke Engine Co., 604 Seventh St., Grand
Haven, Mich.
Famco Machine Co., 3134 Sheridan Rd.,
Kenosha, Wis.
Hannifin Corp., 1101 S. Kilbourn Ave., Chlcago,
Ill. III.
Logansport Machine Co., Inc., 810 Center Ave.,
Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St.,
Jackson, Mich.
Watson-Stillman Co., Div. H. K. Porter Co.,
Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich. Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Bliss Co., E. W., 13/5 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., Detroit 13, Mlch. Dake Engine Co., 604 Seventh St., Grand Haven, Mlch. Ferracute Machine Co., Bridgeton, N. J. Lake Erle Engrg. Co., Kemmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oligear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Div. H. K. Porter Co., Wis. Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Die Tryout

Alpha Tool Works, 9281 Freeland Ave., Detroit 28, Mich.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincin-nati, Ohlo. Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Chambersburg Engrg. Co., Chambersburg, Pa. (Continued on page 398)





The unpredictable nature of tractor service, its frequent and unavoidable severity, leave no alternative to gear specifications of the most rigid character including close dimensional tolerances.

Furthermore in order to attain maximum gear service life and avoid critical "end bearing" due to slight changes in alignment under sudden overloads, the drive gear teeth are shaved to the Elliptoid (crowned) Form.

In a recently published article on Caterpillar gear production, reference was made to gear shaving as an important factor in production economy. "Shaving not only controls dimensional characteristics of our gears, correcting gear-cutting errors and producing quiet running tooth surfaces, but also eliminates final lapping operations which were essential before shaving was adopted."

If you have to meet rigid gear specifications investigate Red Ring Gear Shaving. It delivers Precision with Economy.



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WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

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Wilson, K. R., 215 Main St., Buffalo, N. Y. Wood, R. D., Co., Public Ledger Bldg., Phila-delphia 5, Pa. Wood, R. D., Co., Public Ledger Bidg., Philo-delphia 5, Pa. Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio. amco Machine Co., 3134 Sheridan Rd., Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis. Ferracute Machine Co., Bridgeton, N. J. Niagara Machine & Tool Works, 683 North-Iand Awo., Buffalo, N. Y. V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio. American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincin-Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio. Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton,
Ohio.
Clearing Machine Corp., 6499 W. 65th St.,
Chicago 38, Ill.
Cleveland Punch & Shear Works Co., 3917 St.
Clair Ave., N. E., Cleveland, Ohio.
Dake Engine Co., 604 Seventh St., Grand
Haven, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Div., Emhart Mfg. Co., 760
Windsor St., Hartford I, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave.,
Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morgan Engra. Co., Alliance, Ohio.
National Mchry. Co., Greenfield and Stanton
Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
V & O Press Co., Div. Emhart Mfg. Co.,
Hudson, N. Y.
Verson Alisteel Press Co., 93rd St. and S. Kenwood Ave. Chicago.

V & O Press Co., Div. Eminari Miy. Co., Hudson, N. Y. Verson Allsteel Press Co., 93rd St. and S. Ken-wood Ave., Chicago, III. Inc., Roselle, N. J. Watson-Stillman Co., Div. H. K. Porter Co.,

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich. American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincin-

Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ili.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ili.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit. Mich.

Detroit, Mich. oke Engine Co., 604 Seventh St., Grand Detroit, Mich.
Dake Engine Co., 604 Seventh St., Grand
Haven, Mich.
Denison Engrg, Co., 1160 Dublin St., Columbus
16, Ohio.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 25 Main St.,
Ansonia, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago,
III.

Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, III.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, III.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wison, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

PRESSES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, III.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Bliss Co., E. W., 13/5 Katt Rd., 3. Tt., Cannon, Ohio.

Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.

Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, III.

PRESSES, Sheet Metal Working

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincin-nati, Ohio. Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio. Bath, Cyril, Co., 6984 Machinery Ave., Cleve-land 3, Ohio. Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa. Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y. Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd

Haven, Mich.

Danly Machine Specialties, Inc., 2107 S. 52nd
Ave., Chicago 50, III.

Dreis & Krump Mfg. Co., 7416 Loomis Bivd.,
Chicago 36, III.

Chicago 36, III.

Espen-Lucas Machine Works, Front St. and
Girard Ave., Philadelphia, Pa.

Famco Machine Co., 3134 Sheridan Rd.,
Kenosha, Wis.

Ferracute Machine Co., Bridgeton, N. J.

Henry & Wright Div., Emhart Mrg. Co., 760
Windsor St., Hartford 1, Conn.

Hydraulic Press Mfg. Co., 300 Lincoln Ave.,
Mt. Gilead, Ohio.
Johnson Mch. & Press Corp., 620 W. Indiana
Ave., Elikhart, Ind.

Lake Frie Engra, Corp., Kenmore Station, Buf-

Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elikhart, Ind.
Lake Frie Engrg. Corp., Kenmore Station, Buffolo. N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Sales Service Mch. Tool Co., 2363 University Ave., St. Paul, Minn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Valsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Straightening

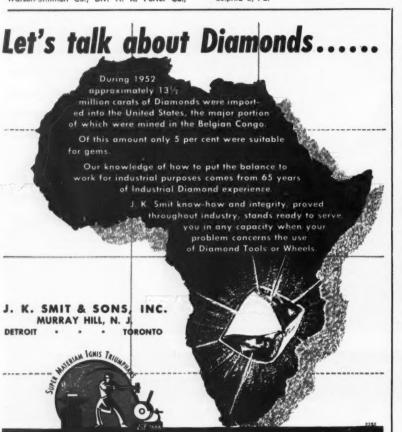
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

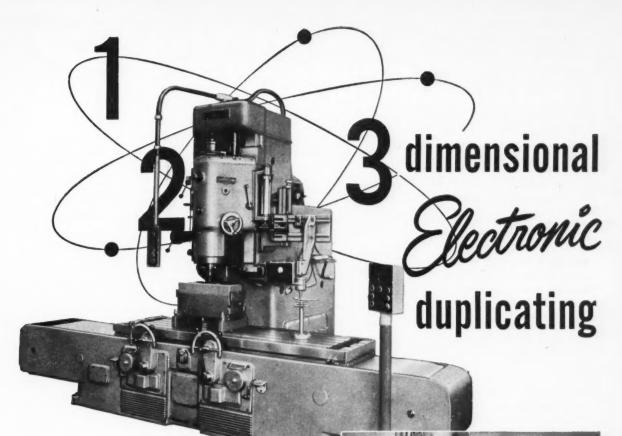
nati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, III.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa. Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.

Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand
Haven, Mich. Hannifin Corp., 1101 S. Kilbourn Ave., Chicago,

III.
Hufford Machine Works, Inc., 1700 E. Grand
Ave., El Segundo, Calif.
Hydraulic Press Mfg. Co., 300 Lincoln Ave.,
Mt. Gilead, Ohio.
Morgan Engre. Co., Alliance, Ohio.
Niogara Mch. & Tool Works (Hydraulic), 683
Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4,
Wis.
Springfield Mch. Tool Co., Springfield, Ohio.

Springfield Mch. Tool Co., Springfield, Ohio. Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J. Wilson, K. R., 215 Main St., Buffalo, N. Y. (Continued on page 400)

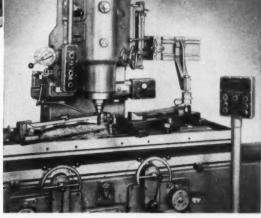




Reed-Prentice HEAVY DUTY NO. 4 MILLERS

Duplicating problems in milling operations are easily solved by the Reed-Prentice No. 4 Vertical Miller equipped with a one-, two- or three-dimensional General Electric contour follower system that assures extreme accuracy.

The versatile Reed-Prentice No. 4 Miller is available in two sizes, providing either 60" or 96" table travel. Both models feature electronic feed drive for table, cross slide and vertical travel.



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MACHINE TOOL REPRESENTATIVES

Philadelphia . . . Calco Machinery Co. Buffalo . J. L. Osgood Machinery Corp. Detroit DoAll Detroit Co. Grand Rapids DoAll Grand Rapids Co. Chicago DoAll Mid-West Co. Milwaukee DoAll Wisconsin Co. Minneapolis . . . Chas. W. Stone Co. Houston . Preston Machine Tool Sales Co. San Francisco . . Montague-Harris Co. Los Angeles King Machinery Co.

MANUFACTURERS OF LATHES, MILLERS, DIE CASTING AND PLASTIC INJECTION MOLDING MACHINES

DESIGN CHANGE TO STEEL **CUTS WEIGHT 50%**

MANY machine designs can be simplified by proper application of welded steel construction. Less material is needed since steel can be formed at low cost to efficient engineering shapes. Steel requires less machining and often eliminates such operations as milling and drilling required with conventional castings.

At Ilg Electric Ventilating Co., Chicago, Illinois, changing over this end bracket to steel provides several distinct advantages. Material cost has been cut considerably as only half as much metal is needed. Also pound for pound steel costs less than gray iron. After welding components in a simple fixture, the only machining that remains is to drill seven holes. Former milling operations are eliminated.

Although half the amount of metal is needed with steel, the part is actually stronger and more rigid than the original construction. It is easier to clean and paint and costs 30% less to produce.





Machine Design Sheets showing how to simplify designs and cut costs are available on request. Designers and Engineers write on your letterhead to Dept. 1204.

THE LINCOLN ELECTRIC COMPANY CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

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Consolidated Mch. Tool Corp., Rochester, N. Y. Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George, Machine Co., 1110 W. 13th St.,
Rocine, Wis. Racine, Wis.
Morey Mchry. Co., Inc. (and Affiliated com-panies), 410 Broome St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, III.

Prince Engineering Co., Inc., Aurora, III. Pratt & Whitney, West Hartford 1, Conn. Sheffield Corp., 721 Springfield, Dayton, Ohio.

Boston Gear Works, 3200 Main St., North Quincy 71, Mass. Pull Gear Co., 21125 Dequindre St., Hazel Park, Mich.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620
E. Vienna Ave., Milwaukee, Wis.
Ingersol-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave.,
Logansport, Ind. Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.

Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich. Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, III.
Berthlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, III.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, III. Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.
Vinco Corp., 9113 Schaefer Highway, Detroit
28, Mich.
Watson-Stillman Co., Div. H. K. Porter Co.,
Inc., Roselle, N. J.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas. Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Pump & Mfg. Co., 19679 John R St.,
Detroit, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson
Blyd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St.,
Rockford, Ill.
Turhili Pump Co., 939 E. 95th St., Chicago 19,
Ill. Vickers, Inc., 1402 Oakman Bivd., Detroit, Mich. Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

PUNCHING MACHINERY

Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.

Buffalo, Forge Co., 490 Broadway, Buffalo, N. Y.

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.

Cleveland Punch & Shear Works Co., 3917 St.

Clair Ave., N. E., Cleveland, Ohio.

Consolidated Mch. Tool Corp., Rochester, N. Y.

Famco Machine Co., 3134 Sheridan Rd.,

Kenosha, Wis.

Ferracute Machine Co., Bridgeton, N. J.

Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.

Niagara Mch. & Tool Works, 683 Northland

Ave., Buffalo, N. Y.

O'Neil-Irwin Mfg. Co., Lake City, Minn.

Ryerson, Joseph T., & Son, Inc., 2558 W. 16th

St., Chicago 18, Ill.

Watson-Stillman Co., Iol. U. H. K. Porter Co.,

Inc., Roselle, N. J.

Wiedemann Machine Co., 4272 Wissahickon

Ave., Philadelphia, Pa.

PYROMETERS

Bristol Co., Platts Mills, Waterbury, Conn.

RACKS, Gear Cut

Amgers, Inc., 6633 W. 65th St., Chicago 38, III.
Atlantic Gear Works, Inc., 200 Latayette St.,
New York 12, N. Y.
Boston Gear Works, 3200 Main St., North
Quincy 71, Mass. Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I. Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestcad St., Hartford, Conn.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass. Massachuserts Geor & Foot Co., 3o Hassad St., Woburn, Mass. Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio. Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa. Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.,
Varner & Swasey Co., 8701 Carnegle Ave.,
Cleveland 3, Ohio.

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REAMERS

Atrax Co., Newington, Conn.

Barber-Colman Co., Rock and Montague, Rockford, Ill.

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.

Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.

Chicago-Latrobe Twist Drill Works, 411 W.

Ontario St., Chicago, Ill.

Cleveland Twist Drill Co., 1242 E. 49th St.,

Cleveland, Ohio.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich. REAMERS burgh 30, Pa.

Gairing Tool Co., 21225 Hoover Rd., Detroit
32, Mich.

Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.

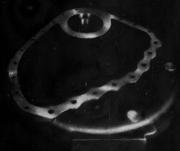
Greenfield Top & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide &
Carbon Corp., 30 E. 42nd St., New York
N. Y. N. Y. Illinois Tool Works, 2501 North Keeler Ave., Chicago, III.

Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse. N. Y. cuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Mead-ville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.

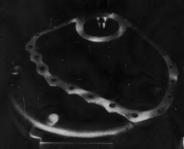
(Continued on page 402)

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OPERATING HEADS AND FIXTURE SECTION FOR DRILLING & TAPPING **Right Hand Parts**





OPERATION DETAILS

LEFT HAND PART POSITION 1

Remove and Load

POSITION 3

Vertical Head Tap 4 Holes L. H. Horizontal Head

Tap 4 Holes

POSITION 2

Vertical Head Idle

L. H. Horizontal Head Tap 3 Holes

RIGHT HAND PART

POSITION 1

Remove and Load

POSITION 3

Vertical Head Drill 8 Holes

R. H. Horizontal Head

Tap 4 Holes

POSITION 2

Vertical Head

Tap 8 Holes

R. H. Horizontal Head Tap 3 Holes



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Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor
Hwy., Detroit 1, Mich.

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Barber-Colman Co., Rock and Montague, Rockford, III.
Carboloy Dept., General Electric Co., Box 237,
Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit
32 Mich. Gairing Tool Co., 21243 32, Mich. Gorham Tool Co., 14400 Woodrow Wilson, Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich. Greenfield Tap & Die Corp., Greenfield, Mass. Madison Mfg. Co., Muskegon Heights, Mich. McCrosky Tool Corp., 1938 Thomas St., Mead-ville, Pa. Morse Twist Drill & Mch. Co., New Bedford, Mass.

Mass. Pratt & Whitney, West Hartford 1, Conn. Standard Tool Co., 3950 Chester Ave., Cleve-

Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.

REAMERS, Taper Pin

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Line, Vt.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y. cuse, N. Y. orse Twist Drill & Mch. Co., New Bedford,

Butterfield Div., Union Twist Drill Co., Derby

National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich. Pratt & Whitney, West Hartford 1, Conn. Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio. Union Twist Drill Co., Athol, Mass.

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Kaufman Manufacturing Co., Manitowoc, Wis. Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

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RECORDING INSTRUMENTS for Pressure

Bristol Co., Platts Mills, Waterbury, Conn.

RECORDING INSTRUMENTS for Speed

Bristol Co., Platts Mills, Waterbury, Conn.

RECORDING INSTRUMENTS for Temperature

Bristol Co., Platts Mills, Waterbury, Conn.

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Nilson, A. H., Mch. Co., 1506 Rallroad Ave., Bridgeport, Conn. U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORIES, Heat-Treating Furnace

Norton Co., 1 New Bond St., Worcester 6,

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Bristol Co., Platts Mills, Waterbury, Conn. General Electric Co., Schenectady, N. Y.

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Oakite Products, Inc., 19 Rector St., New York, N. Y.

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Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

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Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis. General Electric Co., Schenectady, N. Y. Westinghouse Electric Corp., Pittsburgh 30, Pa.

RIVET SETS

Bethlehem Steel Co., Bethlehem, Pa. Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas. Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio. Peck, Stew & Wilcox Co., Southington, Conn.

RIVETERS, Hydraulic

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St.,
New York, N. Y.
Hanna Engineering Works, 1752 Elston Ave.,
Chicago, III.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago,
III.

Norgan Engrg. Co., Alliance, Ohio. Wood, R. D., Co., Public Ledger Bldg., Phila-delphia 5, Pa.

RIVETERS, Pneumatic

Chicago Preumatic Tool Co., 6 E. 44th St., New York, N. Y. Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas. Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn Ingersoll-Rand Co., Phillipsburg, N. J. Keller Tool Co., Grand Haven, Mich. Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.

RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo, Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn. Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, III. Tomkins-Johnson Co., Jackson, Mich.

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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Chio.

RUBBER PRODUCTS

Garlock Packing Co., Palmyra, N. Y.

RULES, Steel

Brown & Sharpe Mfg. Co., Providence, R. I. Lufkin Rule Co., Hess Ave., Saginaw, Mich. Millers Falls Co., Greenfield, Mass. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y. Starrett, The L. S., Co., Athol, Mass.

RUST PREVENTIVES

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa. Oakite Products, Inc., 19 Rector St., New York, N. Y. N. Y. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y. (Continued on page 404)



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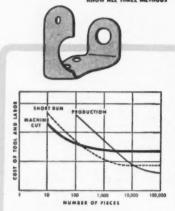
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Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Ingersoll-Rand Co., Phillipsburg, N. J. Jarvis, Charles L., Co., Middletown, Conn. Keller Tool Co., Grand Haven, Mich. Millers Falls Co., Greenfield, Mass. Sundstrand Machine Tool Co., 2331 11th St., e. Rockford, Ill.

SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Blooming-dale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Folls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitch-burg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.

SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa. Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17,
N. Y.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and
Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry, Co., Penton
Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, III. Ryerson, Joseph T., & Son, Inc., 2558 W. 16th 5t., Chicago 18, III. Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Blooming-dale Ave., Chicago, III.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Famco Machine Co., 3134 Sheridan Rd.,
Kenosha, Wis.
Grob Bros., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th
51., Chicago 18, III.
Simonds Saw & Steel Co., 470 Main St., Fitch-burg, Mass.
Tannewitz Works, 315 Front St., N. W., Grand
Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp.,
South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hock

Armstrong-Blum Mfg. Co., 5700 W. Blooming-dale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave.,
White Plains, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th
St., Chicago 18, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting

Alina Corp. 401 Broadway, New York 13, N. Y. (Portable.)
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois 5t., Indianapolis 9, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, III.

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Motch & Merryweather Mchry. Co., Penton Bildg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Metal Cutting Band

Armstrong-Blum Mrg. Co., 5700 W. Blooming-dale Ave., Chicago, III.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Delta Power Tool Div., Rockwell Mrg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th
St., Chicago 18, III.
Simonds Saw & Steel Co., 470 Main St., Fitch-burg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Tannewitz Works, 315 Front St., N. W., Grand
Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp.,
900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. Millers Falls Co., Greenfield, Ohio.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, III.
Frown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford,
Mass.
National Twist Drill & Tool Co., & Winter Bros.
Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, III.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas. Ingersoll-Rand Co., Phillipsburg, N. J. Keller Tool Co., Grand Haven, Mich.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas. Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y. Ingersoll-Rand Co., Phillipsburg, N. J. Jarvis, Charles L., Co., Middletown, Conn. Keller Tool Co., Grand Haven, Mich.

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Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, III.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester I, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa. Eastern Mch. Screw Corp., New Haven, Conn. Morse Twist Drill & Mch. Co., New Bedford, Mass. National Acme Co., 170 E. 131st St., Cleveland, Ohio. Ottemiller, W. H., Co., York, Pa. Standard Pressed Steel Co., Jenkintown, Pa. Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automotic

Single and Multiple Spindle
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17,
N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St.,
Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia
Aves., Rockford, III.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
National Acme Co., 170 E. 131st St., Cleveland,
Ohio.
New Britain Mch. Co., New Britain-Gridley
Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegle Ave.,
Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathe., Turret.

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.

Brown & Sharpe Mfg. Co., Providence, R. I.

Gisholf Machine Co., 1245 E. Washington Ave.,
Madison 10, Wis.

Hardinge Bros., Inc., 1418 College Ave., Elmira,
N. Y.

Orban, Kurt, Co., Inc., 205 East 42nd St.,
New York 17, N. Y.

Rivett Lathe & Grinder, Inc., Brighton, Boston
35, Mass.

Simmons Mch. Tool Corp., 1600 N. Broadway,
Albany, N. Y.

Warner & Swasey Co., 5701 Carnegie Ave.,
Cleveland 3, Ohio.

SCREW PLATES

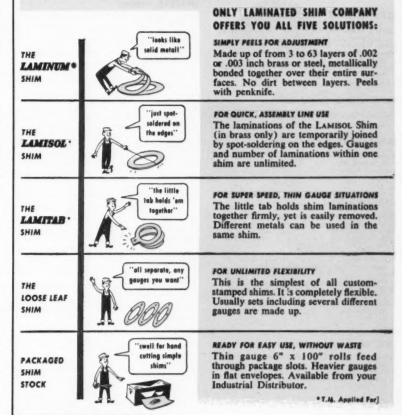
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass. Morse Twist Drill & Mch. Co., New Bedford, Mass.
Proft & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

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Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bristol Co., Platts Mills, Waterbury, Conn.
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Set Screw & Mfg. Co., 35 Main St., Bartlett, Ill.
Standard Pressed Steel Co., JenkIntown, Pa.
(Continued on page 406)



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De Laval Separator Co., Poughkeepsie, N. Y.

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Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Lavai Separator Co., Poughkeepsie, N. Y.
Jones & Laughlin Steel Corp., Gateway Center
No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div.,
Republic Bldg., Cleveland I., Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg.,
Cleveland, Ohio.
Summerill Tubing Co., Div. Columbia Steel &
Shafting Co., P. O. Box 1557, Pittsburgh
30, Pa.

SHAFTS

National Forge & Ordnance Co., Irvine, Warren County, Pa. Standard Pressed Steel Co., Jenkintown, Pa. Summeriil Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30. Pa.

SHAFTS, Flexible

Jarvis, Chas. L., Co., Middletown, Conn. Precise Products Corp., 1328-30 Clark St., Racine, Wis.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa. Cumberland Steel Co., Cumberland, Md. Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa. LoSalle Steel Co., Hammond, Ind. National Forge & Ordnance Co., Irvine, Warren National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Carp., Union Drawn Steel Div., Republic Bidg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, III.

SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio. Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y. Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shoper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Hendey Machine Co., Inc., Torrington, Conn. Morton Mfg. Co., Muskegon Heights, Mic., Onsrud Machine Works, Inc., 3940 Palmer St., Chicago. III. Onsrud Matrine Tonico (Chicago, III.)
Orban, Kurt, Co., Inc., 205 E. 42nd St., New York I.7, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, III.
Rockford, III. Rockford, III.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox
Ave., Chicago 41, III.
South Bend Lathe Works, Inc., 425 E. Madison
St., South Bend, Ind.

SHAPERS, Vertical

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y. Austria Industrial Corp., 76 Mamaraneek Ave., White Plains, N. Y.
British Industries Corp., International Mchry. Div., 164 Duane St., New York, N. Y.
Pratt & Whitney, West Hartford I, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford Mch. Rockford, III.

SHAPES, Cold Drawn Steel

Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa. Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh

SHAPES, Structural

James, structural
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Loughlin Steel Corp., Gateway Center
No. 3 Bldg., Pittsburgh, Pa.
U. S. Steel Corp. (Carnegic-Illinois Steel Corp.
Div., Columbia Steel Co. Div., Tennessee
Coal, Iron & R. R. Co., Div.), 436 7th Ave.,
Pittsburgh, Pa.

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa. Buffalo Forge Co., 490 Broadway, Buffalo, Bethlehem Steel Co., Bethlehem, Pa. Buffalo, Forge Co., 490 Broadway, Buffalo, N. Y. Circinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio. Cleveland Crane & Engrg. Co., Wickliffe, Ohio. Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio. Consolidated Mach. Tool Corp., Rochester, N. Y. Ferrocute Machine Co., Bridgeton, N. J. Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, III. III.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works, 683 Northland
Ave., Buffalo, N. Y.
O'Neil-Irvin Mfg., Lake City, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, III.
Watson-Stillman Co., Div. H. K. Porter Co.,
Inc., Roselle, N. J
Yoder Co, 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2,

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St.
Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland
Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main
St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St.
Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheridan Rd.,
Kenosha, Wis.
Niagara Mch. & Tool Works, 683 Northland
Ave., Buffalo, N. Y.

Peck, Stow & Wilcox Co., Southington, C Simonds Saw & Steel Co. (Blades), 470 St., Fitchburg, Mass.

SHEET METALS

Aluminum Co. of America, Oliver Bldg., Pitts-burgh, Pa. American Brass Co., 25 Broadway, New York, N. Y.

Bethlehem Steel Corp., Bethlehem, Pa.

Chase Brass & Copper Co., Inc., 1949 Rodney
St., Waterbury 20, Conn.

Republic Steel Corp., Republic Bidg., Cleveland
1, Ohio.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, Ill.

Solar Steel Corp., Union Commerce Bidg.,
Cleveland, Ohio.

U. S. Steel Corp. (Carnegie-Illinois Steel Corp.
Div., Columbia Steel Co., Div., Tennessee
Coal, Iron & R. R. Co., Div.), 436 7th Ave.,
Pittsburgh, Pa.

SHEETS, Iron and Steel

SHEETS, Iron and Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Corp., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center
No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland
1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, III.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp.
Div., Columbia Steel Co. Div., Tennessee
Coal, Iron & R. R. Co., Div.), 436 7th Ave.,
Pittsburgh, Pa.

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Reaver Tool & Engineering Corp., 2850
Rochester Rd., Box 429, Royal Oak, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon
Corp., 30 E. 42nd St., New York, N. Y.
Morse Twist Drill & Mch. Co., New Badford,
Mass. Morse Twist Drill & Mch. Co., New Badford, Mass. National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio. Consolidated Mch. Tool Corp., Rochester, N. Y. Lobdell United Co., 2000 "G" St., Wilmington kford Mch. Tool Co., 2500 Kishwaukee St., ockford, III. 99, Del Rockford Rockfor

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicogo, III.
Chicogo-Latrobe Twist Drill Wks. 411 W. Ontario St., Chicago III.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass. Mass. National Twist Drill & Tool Co., Rochester, National Twist Drill & 1001 Co., Rocriester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio. Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa. Barnes Drill Co., 814 Chestnut, Rockford, Ill. Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill. Barh, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohlo. Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass. Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich. Bethlehem Steel Co., Bethlehem, Pa. Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa. Birdsboro, Steel Fdry. & Mch. Co., Birdsboro, Pa. Blanchard Mch. Co., 64 State St., Cambridge, Mass. Mass. Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton,

(Continued on page 408)

SOUTH BEND 900 TURRET LATHE

Keeps Production W and Costs DOWN on Precision Parts

Here's the precision turret lathe that has everything needed to consistently and economically turn out volumes of small precision parts.

High output comes easy on the 900 Turret Lathe. It's fast and simple to handle—operator fatigue is less. Wide ranges of speeds and power feeds permit machining at maximum efficiency on every type of operation. Tolerances are no problem; the rigidity and exactness with which it is built produces exceptional accuracy that can be maintained without sacrificing speed. Tool changes also are quickly made.

It is these advantages, that keep production up and costs down, which also make this turret lathe perfect for second operations. If output and tolerances are problems on any small parts you are producing, it will pay you to find out about the 900 Turret Lathe. Send coupon for information.

SPECIFICATIONS

Collet Capacity—½″ Spindle Bore—¾″

Swing — 9¼" over bed, 3-9/16" over double tool cross slide, 5½" over compound cross slide.

Turret to Spindle Distance—205%"

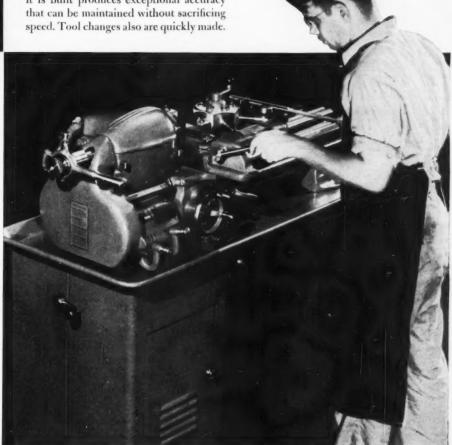
Spindle Speeds—12; 41 to 1270 r.p.m.

Power Longitudinal Feeds—48

Power Cross-feeds-48

Thread Cutting — 48 pitches R. H. or L. H. 4 to 224 per inch.





	BENCH LATHES	FLOC-R LATHES	12 dand 1" Collet TURRET LATHES	DRILL PRESSES	BENCH SHAPER
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Columbus Die-Tool & Mch. Co., 955 Cleveland
Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., 629 Railroad
Ave., Bridgeport 5, Conn.
Douglas Tool Co., 2300 E. Nine Mile Rd., Hazel Douglas Tool Co., 2300 E. Nine Mile Rd., Hazel Park, Mich.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Ceil-O Corp., 1200 Oakman Bivd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 29, Po.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Frant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
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Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill. Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn. Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohlo.

Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, III.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y. Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo., Lipe-Rollway Corp., 806 Emerson Ave., Syra-cuse, N. Y. Mathemann Machine Land cuse, N. Mathewson Machine Works, Inc., 28 Hancock St., Quincy 71, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Molline Tool Co., 102 20th St., Molline, III.
Molline Tool Co., 101, Molline, III.
Morgan Engrg. Co., Alliance, Ohlo.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Clincinnati 3, Ohlo.
Motch & Merryweather Mchry. Co., Penton
Bldg., Cleveland, Ohlo.
National Acme Co., 170 E. 131st St., Cleveland, Ohio. land, Ohio. land, Ohio.
National Automatic Tool Co., Inc., S. 7th and
N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean
Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave.,
Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester,
Alich. Mich.
New Britain Mch. Co., New Britain-Gridley
Mch. Div., New Britain, Conn.
New Jersey Geor & Mfg. Co., 1470 Chestnut
Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland
Ave., Buffalo, N. Y.
Oligear Co., 1560 W. Pierce St., Milwaukee 4
Wis.
OK Tool Co. Attick. Wis.

OK Tool Co., Milford, N. H.

Ploneer Engrg. & Mfg. Co., 19679 John R St.
Detroit, Mich.
Ploneer Pump & Mfg. Co., 19679 John R St.,
Detroit, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St.,
Racine, Wis.
Red-Prentice Corp., 677 Cambridge St., Worzester, Mass.

Tatt-Peirce Mrg. Co., Voorscher, N., Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Union Twist Drill Co., Athol, Mass.
Universol Engineering Co., Frankenmuth 2, Mich.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Walker Hydraulic Duplicator Co., Box 200, Standish. Mich. Standish, Mich.

Standish, Mich.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicoco Machine Corp., Stenton Ave. and
Louden St., Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

Reed-Prentice Corp., 677 Cambridge St., Wor-cester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, III.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

SPEED REDUCERS

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y. Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, III. Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio. Cone-Drive Gears, Div. Michigan Tool Co., Cleveland, Ohio.
Cone-Drive Gears, Dlv. Michigan Tool Co.,
7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St.,
Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
James, D. O. Gear Mfg. Co., 1140 W. Monroe
St. Chicago 7, III.
Link-Belt Co., 2045 W. Huntington Park Ave.,
Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland,
Ohio. Ohio.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philodelphia Gear Works, Inc., Erie Ave. and G St., Philodelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wie Westinghouse Electric Corp., Pittsburgh 30, Pa.

SPINDLES, Grinding

SEX-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. Pope Mchry. Corp., Haverill, Mass. Precise Products Corp., 1328-30 Clark St., Racine, Wis. Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y. Boston Gear Works, 3200 Main St., North Quincy 71, Mass. Link-Belt Co., 220 S. Belmont Ave., Indian-apolis 6, Ind. Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio. Onio. niladelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Amgers, Inc., 6633 W. 65th St., Chicago 38, III.
Atlantic Gear Works, Inc., 200 Lafayette St.,
New York 12, N. Y.
Boston Gear Works, 3200 Main St., North
Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead
St., Hartford, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland,
Ohio. Ohio. Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa. Stahl Geor & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, All Metal

LaSalle Steel Co., Hammond, Ind. Mullins Monufacturing Corp., Salem, Ohio.

STAMPINGS, Sheet Metal

Aluminum Co. of America, Oliver Bldg., Pitts-Aluminum Co. of America, Oliver Biog., Pitts-burgh, Pa. Laminated Shim Co., Inc., Glenbrook, Conn. Mullins Manufacturing Corp., Salem, Ohio. Republic Steel Corp., Niles Steel Products Div., Republic Bidg., Cleveland 1, Ohio. Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STAMPS, Steel and Marking Dies

Hoggson & Pettis Mfg. Co., 149 Brewery St., New Haven, Conn.

STEEL

STEEL

Alleghey Ludium Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel
Corp., Rockefeller Bldg., Cleveland, Ohlo.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co., of America, Chrysler Bldg.,
New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center
No. 3 Bldg., Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren
County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland
1, Ohlo. 1, Ohio.
T., Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio. Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh Shafting Co., P. U. Bun 100.
30, Pa.
30, Pa.
imken Roller Bearing Co., Canton, Ohio.
1, S. Steel Corp. (American Steel & Wire Co.
Div., Carnegle-Illinois Steel Corp. Div., Columbia Steel Co., Div. Tennessee Caal, Iron.
8, R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
1, S. Steel Supply Div., U. S. Steel Co., 208 S.
LaSalle St., Chicago 4, Ill.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio. Bethlehem Steel Co., Bethlehem, Pa. Crucible Steel Co., of America, Chrysler Bldg., New York, N. Y.

Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.

LaSolle Steel Co., Hammond, Ind.

Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

Summerill Tubling Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

Timken Roller Bearing Co., Conton, Ohio. Timken Roller Bearing Co., Canton, Ohio. U. S. Steel Corp. (American Steel & Wire Co. Div.), 436 7th Ave., Pittsburgh, Pa.

Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill. Bethlehem Steel Co., Bethlehem, Pa. Carpenter Steel Co., Reading, Pa. Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y. Firth Sterling Inc., 3113 Forbes St., Pitts-burgh 30, Pa. Republic Steel Corp., Republic Bldg., Cleveland 1, Ohlo. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill. Simonds Saw & Steel Co., 470 Main St., Fitch-burg, Mass. Solar Steel Corp., Union Commerce Bldg., Simonas Sur a state, burg, Mass.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg.,
New York, N. Y.
Jones & Laughlin Steel Corp., Gateway Center
No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Republic Bldg., Cleveland
I, Ohio. Republic steel Corp., Republic Blog., Clicker, Nohio. T., Ohio. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill. Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio. Timken Roller Bearing Co., Canton, Ohio. Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel
Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Fae.
Carpenter Steel Co., Rethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg.,
New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30. Pa. Crucible Steel Co. of America, Chryste Jose, New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pitts-burgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland I, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div.), 436
7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio. Bethlehem Steel Co., Bethlehem, Pa. (Continued on page 409)

Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa. Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.

Republic Steel Corp., Republic Blog.,
J., Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg.,
Cleveland, Ohio.
U. S. Steel Corp. (American Steel & Wire Co.
Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron &
R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Carpenter Steel Co., Reading, Pa.

Firth Sterling Inc., 3113 Forbes St., Pitts-burgh 30, Pa.

Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.

Simonds Saw & Steel Co., 470 Main St., Fitch-burg, Mass. Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludium Steel Corp., Pittsburgh, Pa. Selar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

STEEL ALLOYS

See Alloys, Steel.

STEEL BARS-See Bors, Steel

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg Co., Providence, R. I. Starrett, The L. S., Co., Athol, Mass.

Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp. (Allay), 30 E. 42nd St., New York, N. Y.

STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.

Card, S. W., Mfg. Co., Div. Union Twist Drill Co, Mansfield, Mass.

Greenfield Top & Die Corp., Greenfield, Mass. Morse Twist Drill & Mch. Co., New Bedford, Moss.

Pratt & Whitney, West Hartford 1, Conn.

Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

STONES, Oil or Sharpening

Bay State Abrasive Co., Westboro, Mass. Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.

Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS

Standard Pressed Steel Co., Jenkintown, Pa. (Continued on page 410)



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STRAIGHTENERS, Flat Stock and Wire

Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

Chambersburg Engrg. Co., Chambersburg, Pa. Colonial Broach Co., Detroit 13, Mich.

Consolidated Mch. Tool Corp., Rochester, N. Y. Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, III.

Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.

Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.

Morse Twist Drill & Mch. Co., New Bedford, Mass.

Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.

Springfield Mch. Tool Co., Springfield, Ohio. Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

STUD SETTERS

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, III.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

See Plates, Surface.

SWAGING MACHINES

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.

Torrington Co., Torrington, Conn.

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GRH

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General Electric Co., Schenectady, N. Y.

Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, III.

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

TACHOMETERS

Bristol Co., Platts Falls, Waterbury, Conn.
Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.

Vender-Root, Inc., 20 Sargent St., Hartford, Conn.

(Continued on page 412)

DEEP DRAWING

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In only four draws Multipress converts .040 gauge aluminum blanks from $7\frac{1}{8}$ " flat discs to gracefully flared tumblers $4\frac{3}{4}$ " deep.

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costcutting
oil-smooth
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formed
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Pratt & Whitney, West Hartford 1, Conn.

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Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.

McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.

Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, III

TAPPING ATTACHMENTS AND DEVICES

Baker Bros., Inc., Station F, P. O. Bex 101, Toledo 10, Ohio.

Brown & Sharpe Mfg. Co., Providence, R. 1.

Errington Mechanical Laboratory, Inc., 24 Nerwood Ave., Stapleton, S. 1., N. Y.

Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.

Homestrand, Inc., Larchmont, N. Y.

Jarvis, Chas. L., Co., Middletown, Conn.

Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.

Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.

McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, III.

Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill. Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St.,
Rockford, Ill.

Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.

Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

Challenge Mchry. Co., Grand Haven, Mich.

Cleveland Tapping Machine Co., Canton 6, Ohio.

Cross Co., 3250 Bellevue Ave., Detroit 7, Mich. Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.

Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, III.

Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.

Hill Acme Co., 1201 W. 65th St., Cleveland 2,

Jarvis, Chas. L., Co., Middletown, Conn.

Kaufman Manufacturing Co., Manitowoc, Wis. Kingsbury Mch. Tool Corp., Keene, N. H.

Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.

Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.

Moline Tool Co., 102 20th St., Moline, III.

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind. Procurier Safety Chuck Co., 18 S. Clinton St., Chicago, III.

Snow Mfg. Co., 435 Eastern Ave., Bellwood, III.

TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS

Besly-Welles Corp., Beloit, Wis.

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.

Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.

Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.

Detroit Tap & Tool Co., Detroit, Mich.

Geometric Tool Co., Westville Station, New Haven 15, Conn.

Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. Solid Adjustable), Waynesboro, Pa.

Morse Twist Drill & Mch. Co., New Bedford, Mass.

Pratt & Whitney, West Hartford 1, Conn.

Sheffield Corp., 721 Springfield, Dayton, Ohio. Standard Tool Co., 3950 Chester Ave., Cleveland. Ohio.

Threadwell Top & Die Co., 16 Arch St., Greenfield, Mass.

Winter Bros. Co., Rochester, Mich.

Wood & Spencer Co., 1930 Ł. 61st St., Cleveland, Ohio.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.

Landis Mch. Co., Waynesboro, Pa.

Notional Acme Co., 170 E. 131st St., Cleveland,

Sheffield Corp., 721 Springfield, Dayton, Ohio.

TELESCOPES, Alignment

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, III.

THERMOMETERS, Indicating and Recording

Bristol Co., Platts Mills, Waterbury, Conn.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17,
N. Y.

Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.

Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Spring-field, Vt.

Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.

Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio. Kaufman Manufacturing Co., Manitowoc, Wis.

Landis Mch. Co., Waynesboro, Pa.
Magna Engineering Carp., 110 Linfield Drive, Menlo Park, Calif.

Pratt & Whitney, West Hartford 1, Conn.

Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, III.

Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Snow Mfg. Co., 435 Eastern Ave., Bellwood, III. Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

Detroit Tap & Tool Co., Detroit, Mich.

Eastern Mch. Strew Corp., New Haven, Conn. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

Geometric Tool Co., Westville Station, New Haven 15, Conn.

Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

Landis Mch. Co., Waynesboro, Pa.

Prott & Whitney, West Hartford 1, Conn.

Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Sheffield Corp., 721 Springfield, Dayton, Ohio. Taft-Peirce Mfg. Co., Woonsocket, R. I.

Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread.

THREAD MILLING MACHINES

Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.

Cross Co., 3250 Bellevue Ave., Detroit 7, Mich. Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.

Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.

Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St.,

Sheffield Corp., 721 Springfield, Dayton, Ohlo.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING MACHINES

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.

Hill Acme Co., 1201 W. 65th St., Cleveland 2,

Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

Salvo Tool & Engineering Co., 26441 Gratlet Ave., Roseville, Mich.

V & O Press Co., Div., Emhart Mfg. Co., Hudson, N. Y.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.

Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.

Republic Steel Corp., Republic Bldg., Cleveland
1. Ohio.

Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

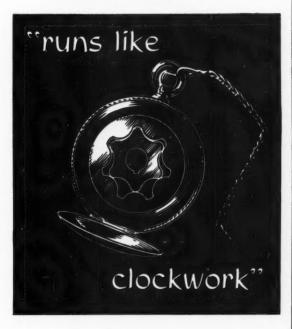
U. S. Steel Corp. (Carnegie-Illinois Steel Corp.
Div. Columbia Steel Co. Div., Ternessee
Coal, Iron & R. R. Co., Div.), 436 7th
Ave., Pittsburgh, Pa.

(Continued on page 414)

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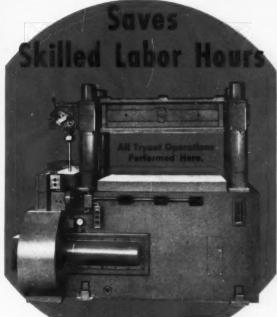
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Firth Sterling Inc., 3113 Forbes St., Pitts-burgh 30, Pa.

Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.

Illinois Tool Works, 2501 North Keeler Ave.,

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.

Simonds Saw & Steel Co., 470 Main St., Fitch-burg, Mass. Vanadium Alloys Steel Co., Latrobe, Pa.

Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.

Firth Sterling Inc., 3113 Forbes St., Pitts-burgh 30, Pa.

Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.

Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

Kennametal, Inc., Latrobe, Pa. Vanadium Alloys Steel Co., Latrobe, Pa.

Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and .Planing Tools.

TOOL GRINDING ATTACHMENTS

Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

eaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich. avis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

Levejoy Tool Co., Inc., Springfield, Vt.

Maxwell Co., 420 Broadway, Bedford, Ohio.

Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich. Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.

OK Tool Co., Milford, N. H.

Portage Double Quick Tool Co., 1036 Sweitzer Ave., Akron 11, Ohio.

R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

Wesson Co., 122 Ferndale, Mach 1220 Woodward Heights Blvd.,

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass. Brown & Sharpe Mfg. Co., Providence, R. I. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

Starrett, The L. S., Co., Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL STEEL

Allegheny Ludium Steel Corp., Pittsburgh, Pa. Bethlehem Steel Co., Bethlehem, Pa.

Carpenter Steel Co., Reading, Pa.

Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.

Firth Sterling Inc., 3113 Forbes St., Pitts-burgh 30, Pa.

Republic Steel Corp., Republic Bldg., Cleveland 1. Ohia.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.

Solar Steel Corp., Union Commerce Blag., Cleveland, Ohio.

Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Atrax Co., Newington, Conn.

Beaver Tool & Engineering Corp., 2850 Rochester RJ., Box 429, Royal Oak, Mich. Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, III.

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit

Firth Sterling Inc., 3113 Forbes St., Pitts-burgh 30, Pa.

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich. Tool Co., 14400 Woodrow Wilson, Gorham

Detroit, Mich. Colonial Broach Co., Detroit 13, Mich.

Illinois Tool Works, 2501 North Keeler Ave., Chicago, III.

Kennametal, Inc., Latrobe, Pa.

Maxwell Co., 420 Broadway, Bedford, Ohio. McCrosky Tool Corp., 1938 Thomas St., Mead-ville, Pa.

Metal Carbides Corp., Youngstown, Ohio.

Morse Twist Drill & Mch. Co., New Bedford, Moss.

Precise Products Corp., 1328-30 Clark St., Racine, Wis.

Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

Union Twist Drill Co., Athol, Mass.

Wesson Metal Corp., Lexington, Ky.

Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

Bullard Co., Brewster St., Bridgeport 2, Conn. Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

rth Sterling Inc., 3113 Forbes St., Pitts-burgh 30, Pa.

Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.

Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

Kennametal, Inc., Latrobe, Pa.

Lovejoy Tool Co., Inc., Springfield, Vt.

Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.

OK Tool Co., Milford, N. H.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.

Wesson Co., 122 Ferndale, Mich. 1220 Woodward Heights Blvd.,

TRANSFER MACHINES, Automotic

Barnes Drill Co., 814 Chestnut St., Rockford,

Barnes, W. F. & John, Co., 201 S. Water St., Rockford, III.

Colonial Broach Co., Detroit 13, Mich.

Cross Co., 3250 Bellevue Ave., Detroit 7, Mich. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

Sundstrand Mch. Tool Co., 2531 11th St., Rockford, III.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed

Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.

Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.

Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

Sundstrand Mch. Tool Co., 2531 11th St., Rockford, III.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman St., Bridge-port 5, Conn.

TUBE FORMING AND WELDING MACHINES

American Elec. Fusion Corp., 2606 Diversey Ave., W., Chicago, III.

Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBING, Aluminum

Aluminum Co. of America, Oliver Bldg., Pitts-burgh, Pa.

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.

Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.

Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Bethlehem Steel Co., Bethlehem, Pa.

Carpenter Steel Co., Reading, Pa.

Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.

National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.

Republic Steel Corp., Steel & Tubes Div., Re-public Bldg., Cleveland 1, Ohio.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III. lar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

Timken Roller Bearing Co., Canton, Ohio. (Continued on page 416)



When the knives on a Steelweld Shear are being set parallel from one end to the other, it is not necessary to have one man at the rear of the machine turning adjustment bolts, with another man at the front gauging the knife clearance. Nor is it necessary to work between or behind the hold-downs in hard-to-reach places.

On Steelwelds the hold-down beam can be lifted out of the way and all knife adjustment bolts reached from the front of the machine. As each bolt is turned, the clearance can be checked

at once. One man can make the entire adjustment in a small fraction of the time usually required.

After the knives have been set for parallel, the clearance between them can be adjusted to suit various plate thicknesses to obtain the best possible cuts. This can be done in a few seconds by turning a crank and watching a dial indicator.

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UNIVERSAL JOINTS

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Boston Gear Works, 3200 Main St., Nerth Quincy 71, Mass.

VALVE CONTROLS

Philadelphia Gear Works (Metorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air

Bellows Co.; 230 W. Market St., Akron, Ohio. Hannifin Corp., 1101 S. Kilbourn Ave., Chicage, III.

Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, III.

Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

Barnes, John S., Corp., Rockford, III.

Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.

Hannifin Corp., 1101 S. Kilbourn Ave., Chlcago, III.

Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.

Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.

Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.

Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Sundstrand Mch. Tool Co., 2531 11th St., Rockford, III.

Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.

Watson-Stillman Co., Dlv. H. K. Porter Co., Inc., Roselle, N. J. Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

VIBRATION INSULATION

American Felt Co, Glenville, Conn.

VISES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Blooming-dale Ave., Chicago, III.

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III. Bellows Co., 250 W. Market, Akron, Ohlo.

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh &, Po.
Hannlfin Corp., 1101 S. Kilbourn Ave., Chicago,
III.

Hendey Machine Co., Inc., Torrington, Conn. Homestrand, Inc., Larchmont, N. Y. Logansport Machine Co., Inc., 810 Conter Ave., Logansport, Ind.

Martin, J. E. Mch. Works, 548 W. State St., Springfield, Ohio.

Springfield, Ohio.

Nelse, Karl A., Dept. M, 381 Fourth Ave.,
New York 16, N. Y.

Producte Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.

Skinner Chuck Co., 344 Church St., New Britain, Conn.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind. Universal Engineering Co., Frankenmuth 2, Mich.

VISES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

VISES, Placer and Shaper

Brown & Sharpe Mfg. Co., Providence, R. I. Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.

Martin, J. E. Mch. Works, 548 W. State St., Springfield, Ohio.

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, III.

Skinner Chuck Co., 344 Church St., New Britain, Conn.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

VISES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, III.

VOLTMETERS

Bristol Co., Platts Mills, Waterbury, Conn. General Electric Co., Schenectady, N. Y.

WASHERS, Lock

Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WASHERS, C, ring

Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WELDING AND CUTTING EQUIPMENT Oxyacetylene

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.

General Electric Co., Schenectady, N. Y.

Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

Westinghouse Electric Corp., Pittsbugh 30, Pa.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.

American Electric Fusion Corp., 2606 Diversey Ave., W., Chicago, III.

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. DoAll Co., 254 Laurel Ave., Des Plaines, III. Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.

WELDMENTS

Mahon, R. C., Co., Detroit 34, Mich.

Mathewson Machine Works, 28 Hancock St., Quincy 71, Mass.

Woods, A. C., & Co., Div. Kropp Forge Co., 1129 Harrison Ave., Rockford, III.

WIRE

American Steel & Wire Co., Div. U.S. Stee Corp., Rockefeller Bldg., Cleveland, Ohio. Bethlehem Steel Co., Bethlehem, Pa.

Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.

Republic Steel Corp., Republic Bldg., Cleveland
1, Ohio.

U. S. Steel Corp. (American Steel & Wire Co. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY

Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WIRE NAIL MACHINERY

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.

National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.

WOODWORKING MACHINERY

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.

Frew Machine Co., 121 East Luray St., Philodelphia 20, Pa.

Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, III.

Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, III.

Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

WORM DRIVES

Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.

Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.

Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.

Philadelphia Gear Works, Erle Ave. and G St., Philadelphia, Pa.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

Cleco Div., Reed Roller Bit Co. (Impact, Pneumatic), 5125 Clinton Ave., Houston 20, Tex.

Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg, N. J. Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

WRENCHES, Detachable Socket

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

WRENCHES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

Peck, Stow & Wilcox Co., Southington, Conn.

WRENCHES, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

Keller Tool Co., Grand Haven, Mich.

WRENCHES, Tap

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.

Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.

Greenfield Tap & Die Corp., Greenfield, Mass. Morse Twist Drill & Mch. Co., New Bedford,

Pratt & Whitney, West Hartford, Conn.

Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

WRENCHES, Torque Measuring

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Sturtevant, P. A., Co., Addison, III.

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Style DMS for hand screw machines, turret lathes, where die head does not rotate.



Style DM for B & S

automatics and small single spindle machines.





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THE PROPER DIE HEAD
FOR THE JOB".

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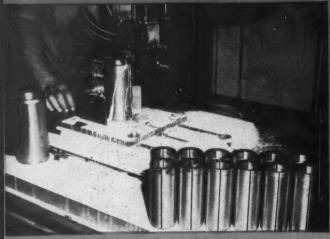
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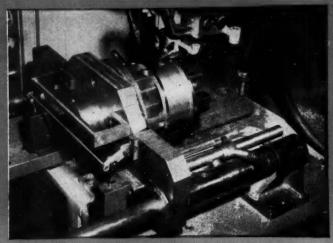


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SLOTTING Slotting bushings, using fixture and special heavy gage DoALL Saw Band to produce desired slot width.

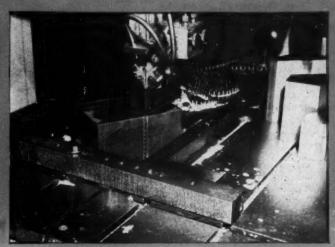


SLITTING Cutting heavy duty bearings in half. Adjustable fixture handles parts up to 11" dia. x 14" length.



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ANGLE CUTTING Back-up bar is boiled to saw table. An angle is boiled to back-up bar. Fully adjustable.



STOCK REMOVAL Excess stock required to hold pinions in gear cutter being removed automatically.

Use of Simple Fixtures Often Lets Bandsawing Replace More Costly Machining Methods

HOW the use of simple fixtures bolted to DoALL power feed bandsaw tables extends the usefulness of the machines in mass production work can be seen from the accompanying illustrations. Many jobs that would otherwise be performed on slower, more expensive machine tools are now being done on DoALL machines because of the user's ingenuity in devising fixtures.

The versatility of the DoALL Contour-matic makes it the preferred machine for production sawing. Variable hydraulic table feed, automatic stop, adjustable pressure coolant flow, adjustable pressure air flow to blow chips away from cut, blade speed range from 10 to 40,000 fpm, band tension control—these are a few of the features of this production machine.

To take advantage of the production economies possible with band machining, call your local DoALL Store, or write:

> The DoALL Company 254 N. Laurel Ave., Des Plaines, III.

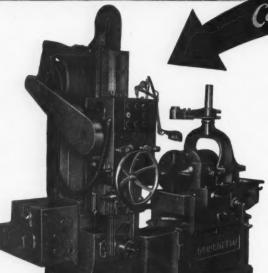


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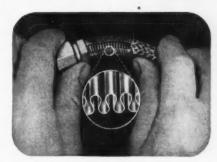
Consider . .

- 1. We make UNIFLEX from seamless, special bronze alloy tube—tough, corrosion-resistant, leak-proof.
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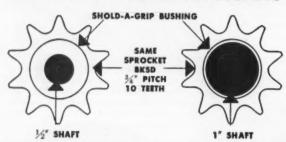
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ONE SPROCKET FITS MANY SHAFT SIZES SIMPLY BY CHANGING THE BUSHING



Example: Sprocket BKSD, 34" pitch, 10 teeth, can be used on **9** different shaft sizes, any size from 1/2" to 1" by 16THS, by inserting the correct size SHOLD-A-GRIP Bushing.

Illustration at top of page is typical design of SHOLD-A-GRIP Bushing and Sprocket with minimum number of teeth.

Illustration at right is typical of design of SHOLD-A-GRIP Bushing and Sprocket with maximum number of teeth.



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FOR SLIP-PROOF GRIP

Boston Gear expert engineering has provided a correct taper in SHOLD-A-GRIP Bushings and Sprockets for slipproof grip. When screws are tightened the bushing grips both sprocket and shaft with maximum holding power, even on shafts which vary from true diameter.

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The Abrasive 18" Face Grinder handles big work, odd shapes and special fixtures — gets out grinding jobs fast and efficiently. By removing the Plexiglas guard, the 13" x 36" work table is completely "in the open" — fully accessible for fast, easy set-up. Transverse and vertical adjustments are by large, conveniently located handwheels.

Longitudinal hand feed also saves set-up

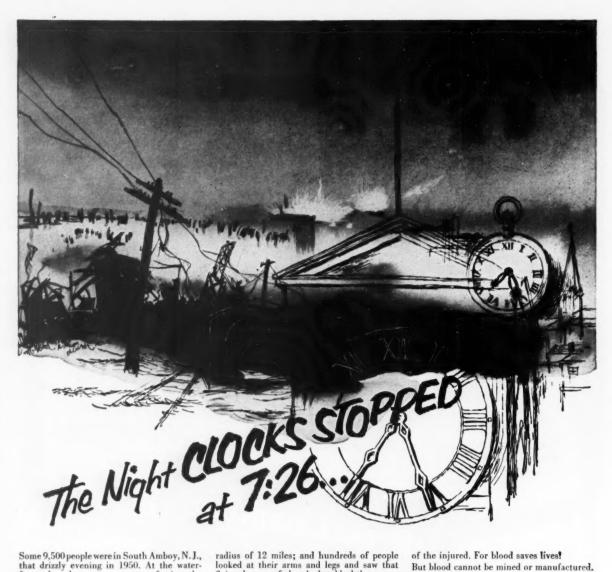
time and eliminates table overrun.

Abrasive 18" Face Grinder has many uses — faces off castings, grinds automobile dies, squares up die blocks, snags castings, does many other jobs where flat, square surfaces are required.

Write for complete details and catalog. Abrasive Machine Tool Company, 12 Dunellen Road, East Providence 14, Rhode Island.

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* Such disasters have happened many times before in America. They could happen again. And if they do—and when they do—there must be blood plasma on hand to take care of the injured. For blood saves lives!

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- Have you arranged to have a Bloodmobile make regular visits?
- Has your management endorsed the local Blood Donor Program?
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- Was this information given through Plant Bul-letin or House Magazine?
- Has your company given any recognition to donors?
- Have you conducted a Donor Pledge Campaign in your company?

Remember, as long as a single pint of blood may mean the dif-ference between life and death for any American . . . the need for blood is urgent!



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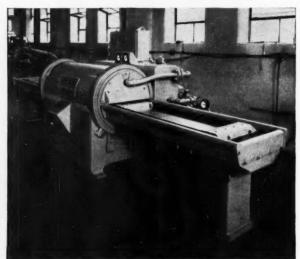


Formed in a conventional rubber pad press

The best way to judge the new Verson-Wheelon Direct Acting Hydraulic Press is to compare its work with that of a conventional rubber pad press. The typical examples illustrated above show the difference. Flanges of Verson-Wheelon formed parts are completely formed. Flanges formed in a conventional rubber pad press are often wrinkled and incomplete and require considerable hand finishing.

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Bulletin VW-52 gives design and operating data. Write for a copy.



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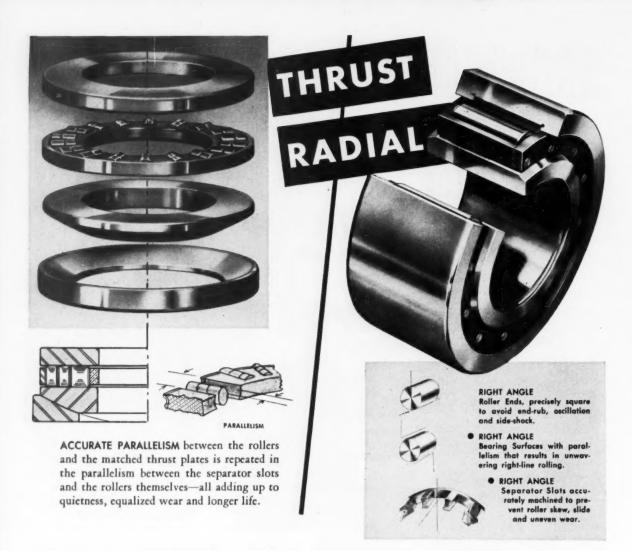
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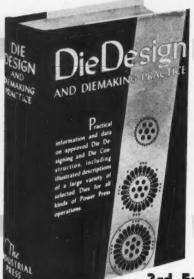
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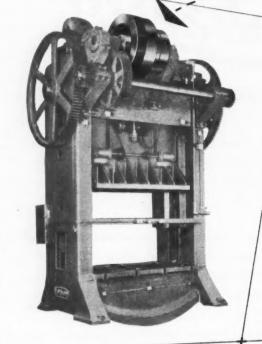




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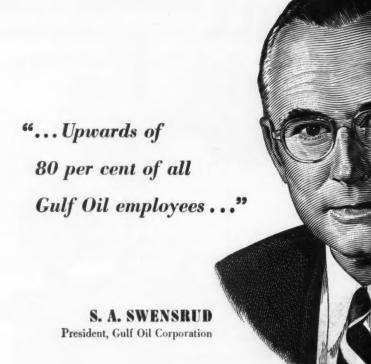
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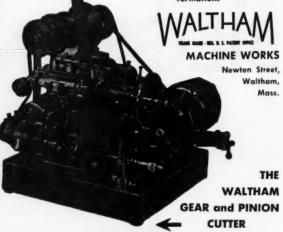
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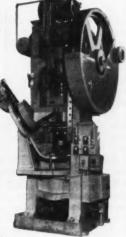
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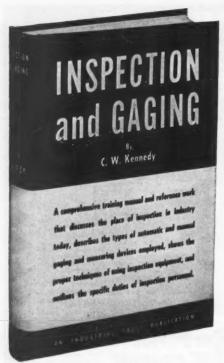
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- How Standards Aid the Inspector
- Basic Principles and Techniques of Measurement
- **Fixed Gages**
- Surface Plate Methods and Equip-
- Mechanical Indicating Equipment
- Electrical and Air Indicating Equip-
- 10 Optical Measuring and Inspection Equipment
- 11 Gaging and Inspection of Screw Threads
- 12 Special Measuring and Inspection **Problems**
- Gage Checking and Calibration
- 100 Per Cent Inspections
- 15 **Quality Control and Sampling**
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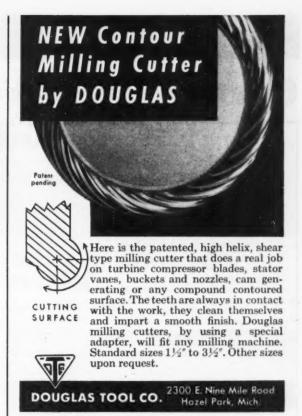
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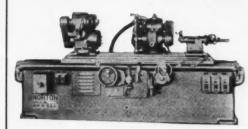
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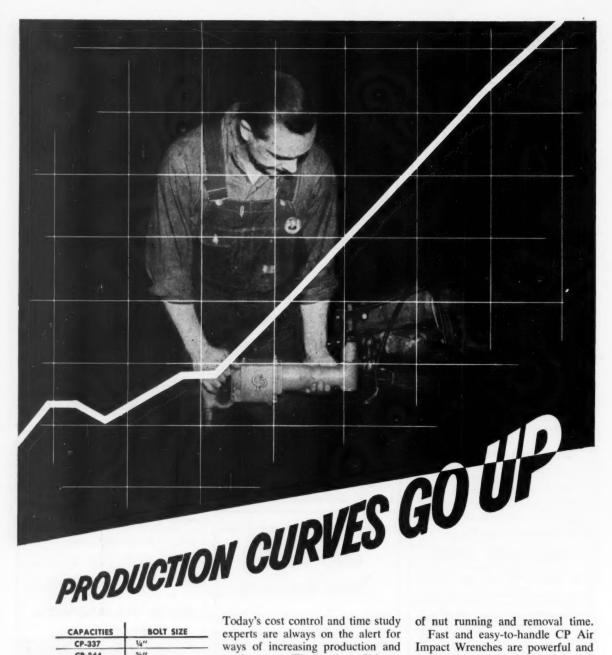
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ALPHABETICAL INDEX OF ADVERTISERS

*

A	LI HABETICAL INDI	DA OF ADVENTIGE	
Α '	Cincinnati Milling Machine	Firth Sterling, Inc 97	Kearney & Trecker Corp. 14-15-123
Abrasive Machine Tool Co. 423 Allegheny Ludlum Steel	Co. 289 Cincinnati Milling Machine Co.	Formsprag Company	Keller Tool Co 360
Corp 106	Grinding Wheels Div. 276-277	Fosdick Machine Tool Co.	Kennametal, Inc. 410 Keo Cutters 442
Allen-Bradley Co.	Cincinnati Milling Products Div., Cincinnati Milling	Frauenthal Div., Kaydon	Neo Cutters
Alina Corporation	Machine Co 25	Engineering Corp 32	L
Alpha Tool Works 413	Cities Service Oil Co 50-51	G	L & J Press Corporation 394 Lake Erie Engineering Corp.
American Broach & Mch. Co., Insert 75-90	Classified Advertisements	Gallmeyer & Livingston Co. 439	26-27
American Chain & Cable 345-443	Clearing Machine Corp. 446-447	Gardner Machine Co 23	Laminated Shim Co., Inc. 404-405
American Felt Co	Back Cover	Garlock Packing Co 296 General Electric Co.	Landis Machine Co 2-3
American Stock Gear Div.,	Cleco Div., Reed Roller Bit	(Insert 73) 303	La Salle Steel Co 10-11
Perfection Gear Co 392 American Tool Works Co 125	Cleveland Crane & Engrg.	Geometric Tool Co. Div. Greenfield Tap & Die	LeBlond, R. K., Machine
Ames, B. C., Co 356	Co. 415 Cleveland Punch & Shear	Corp Insert 64	Tool Co
Amgears, Inc. 396 Anderson Bros. Mfg. Co.,	Wks. Co 432	Gerotor May Corp	Lincoln Electric Co 400
Insert 75-90	Cleveland Tapping Machine	Tool Co. 20-21	Linde Air Products Co., Div., Union Carbide &
Armstrong-Blum Mfg. Co 62 Armstrong Bros. Tool Co 52	Clinton Machine Co 265	Gisholt Machine Co. Insert bet. 32-35	Carbon Corp 148-149
Arrow-Hart & Hegeman	Colonial Broach Co. 58-59 Colts Engineering Ltd. 442	Gleason Works	Link-Belt Co
Electric Co. Insert bet. 106-111 Atlantic Gear Works, Inc. 440	Columbus Die-Tool & Mch.	Gorton, George, Machine	Lodge & Shipley Co 371
Automatic Steel Products, Inc. 342	Co	Co. 40 Goss & DeLeeuw Machine	Logan Engineering Co 146 Logansport Machine Co.,
Axelson Manufacturing Co. 55	Cone Automatic Machine	Co 318	Inc
В	Co., Inc	Govro-Nelson Co. 437 Grant Mfg. & Machine Co. 436	Luers, J. Milton 445
Ball & Roller Bearing Co. 440	Consolidated Machine Tool	Gray, G. A., Co 140	Lufkin Rule Co 322
Barber-Colman Co., Insert 75-90 Bardons & Oliver, Inc 122	Corp 71-373 Continental Tool Works 245	Greenfield Tap & Die Corp., Insert 63	M
Barnes Drill CoInsert 75-90	Cosa Corporation 292-293 Cross Company 252	Greenlee Bros. & Co.,	Madison-Kipp Corp 66
Barnes, John S., Corp. Insert 75-90	Crucible Steel Co. of	Grob Brothers439	Magna Engineering Corp 433 Marae Machinery Corp 328
Bath Cyril Co 362	America	Gulf Oil Corp 375	Martin, J. E 442
Baush Machine Tool Co 137 Bay State Abrasive Products	Cuno Engineering Corp 333	H	Materials Section 91-106 Mattison Machine Works,
Co 136	D	Hall Planetary Co 307	Insert 75-90 McCrosky Tool Corp 279
Beaver Tool & Engineering Corp	Danly Machine Specialties,	Hamilton Tool Co	Mead Specialties Co 359
Bellows Company 275 Besly-Welles Corp 144	Inc. 323 Davis Keyseater Co. 438	Hannifin Corporation 389 Hanson-Whitney Div.,	Metal Carbides Corp. 445 Micro Div., Minneapolis-
Bethlehem Steel Co 95-102	Delco Products Div., Gen-	Whitney Chain Co 311	Honeywell Regulator Co. 332
Bilgram Gear & Machine Works	eral Motors Corp	Hardinge Brothers, Inc 152 Hartford Special Machinery	Micromatic Hone Corp 393 Miles Machinery Co 446
Black & Decker Mfg. Co 138	Rockwell Mfg. Co 346-347	Co 386	Millers Falls Co 358
Blanchard Machine Co	Denison Engineering Co 411 Detroit Broach Co 246	Haynes Stellite Co., Div. – Union Carbide & Carbon	Millholland, W. K., Machin- ery Co., Inc
Boston Gear Works 422	Detroit Reamer & Tool Co. 327	Corp 104	Mitts & Merrill 438 Modern Machine Tool Co 384
Brown & Sharpe Mfg. Co. Front Cover	Diefendorf Gear Corp 441 Diversified Metal Products	H. E. B. Machine Tools, Inc	Moline Tool Co 436
also Insert bet. 234-239	Со	Heald Machine Co.	Monarch Machine Tool Co. 283 Moore Special Tool Co., Inc. 48
Brush Electronics Co 310 Bryant Chucking Grinder Co.	DoAll Company 418-419 Douglas Tool Co 445	Inside Front Cover Hendey Machine Co., Inc 395	Morey Machinery Co., Inc.,
134-135	Dreis & Krump Mfg. Co 438 Dumore Company 314	Hill Acme Co. 60	382-420-437-447 Morgan Engineering Co 441
Bryant Machinery & Engineering Co. 280		Hoggson & Pettis Mfg. Co. 443 Hoglund Engineering &	Morris Machine Tool Co 379
Buffalo Forge Co 294 Bullard Company	E Eastern Machine Serew	Manufacturing Co 377 Horton Chuck Div., E. Hor-	Morse Twist Drill & Machine Co
Insert bet, 52-55	Corp 417	ton & Son Co 370	Motch & Merryweather
Butterfield Div., Union Twist Drill Co Insert 121	Eastern Machinery Co. 446 Eastman Kodak Co. 353	Hufford Machine Works, Inc	Mchry, Co
	Ekstrom-Carlson & Co.	Hunt C. B. & Son, Inc 339	Mummert-Dixon Co 438
C & C Sales Corp 429	Insert 75-90 Eisler Engineering Co., Inc. 438	Hydraulic Press Mfg. Co 385	N
Campbell Machine Div.,	Electrolizing Corporation 431	I	National Acme Co 65-295 National Automatic Tool Co.,
American Chain & Cable 345 Carboloy Department of	Erie Foundry Co 363 Espen-Lucas Machine	Industrial Press 340-341-430-444 Ingersoll Milling Machine	Inc 401
General Electric Co. 91-304-305	Works	Co Insert 75-90	National Broach & Machine
Carborundum Co 68-69	European Machine Tool	Ingersoll-Rand Co 335	National Forge & Ordnance
Card, S. W., Mfg. Co. Insert 119 Carlton Machine Tool Co 128	Fair 435 Ex-Cell-O Corporation 245-258	J	Co
Carpenter Steel Co 98	Expert Welding Machine	Jacobs Manufacturing Co 291 Jahn, B., Mfg, Co 344	National Tube Div., United
Challenge Machinery Co 394 Chambersburg Engineering	Co	James, D. O., Gear Manu-	States Steel Corp 99 National Twist Drill & Tool
Co 387	F W Lines C. 447	Johnson Bronze Co 326	Co
Chase Brass & Copper Co 92 Chicago-Latrobe Twist Drill	Falk Machinery Co 447 Farrel-Birmingham Co., Inc. 331	Jones & Lamson Machine	New Britain Machine Co. New Britain-Gridley Ma-
Co 302	Farval Corp 41	Со 67-147	chine Div. Inside Back Cover New Jersey Gear & Mfg. Co. 441
Chicago Pneumatic Tool Co. 448 Cincinnati Bickford Tool Co. 241	Federal Press Co	K	Niagara Machine & Tool
Cincinnati Gear Co 402	Fellows Gear Shaper Co 4-5 Ferracute Machine Co 297	Kaufman Manufacturing	Works
Cincinnati Grinders, Inc 6-7	refracute Machine Co 291	100	W00

ALPHABETICAL INDEX OF ADVERTISERS—Continued

Nicholson File Co 3	7 R
Nilson, A. H., Machine Co. 35	4 R
Northwestern Tool & Engi-	R
neering Co 44	
Norton Company 46-47-116-11	7 R
0	R
Oakite Products, Inc 9	R
Ohio Crankshaft Co 6	1 1
Oilgear Company	
Oliver Instrument Co 35	
Onsrud Machine Works, Inc. 36	- 17
Orange Roller Bearing Co.,	o R
Inc 5	7
Orban, Kurt, Co., Inc 56-349	9
Osborn Manufacturing Co. 288	8
Ottemiller, William H., Co. 44	5 S
P	S
	0
Pangborn Corporation 450	U C.
Perkins Machine & Gear Co. 32	1 5
Philadelphia Gear Wks, Inc. 48 Pines Engineering Co., Inc.	S
272-27:	3 5
Pope Machinery Corp 14	5 3
Pratt & Whitney Div., Niles-	S
Bement-Pond Co. 49	
Procunier Safety Chuck Co. 374	S
	S
R	S
R and L Tools 28:	
Reed-Prentice Corp 399	
Reed Rolled Thread Die Co. 338	
Rehnberg Jacobson Mfg. Co.	S
Insert 75-90	
Reid Bros. Co., Inc. 405	
Reliance Electric & Engineer-	Si
ing Co	
Republic Steel Corp 100	
republic Steel Corp. ammin 100	, 31

Revere Copper & Brass Inc. 255
Rivett Lathe & Grinder, Inc. 301
Rockford Clutch Div. of
Borg-Warner 376
Rockford Machine Tool Co.,
Insert 75-90
Rollway Bearings Co., Inc. 428
Ross Operating Valve Co 249
Rowbottom Machine Co 420
Russell, Holbrook & Hender-
son, Inc 383
Ruthman Machinery Co 443
Ryerson, Joseph T., & Son,
Inc 154
-
S
Sales Service Machine Tool
Co 388
Scherr, George, Co., Inc. 441-445
Schrader's Son, A 287
Seneca Falls Machine Co. 270-271
Set Screw & Mfg. Co 443
Shafer Bearing Corp 425
Sheffield Corp 267
Sheldon Machine Co., Inc. 380
Shore Instrument & Mfg.
Co., Inc 442
Sidney Machine Tool Co 251
Simonds Abrasive Co 352
Simonds Saw & Steel Co 369
Sinclair Refining Co 124
Skinner Chuck Co 316
Smit, J. K., & Sons, Inc 398
Snow Manufactuing Co 312
South Bend Lathe Works 285-407
Springfield Machine Tool Co. 280
Stahl Gear & Machine Co 441
Standard Gage Co., Inc 74
Standard Electrical Tool Co. 372

ndard Pressed Steel Co.

Standard Tool Co 12
Starrett, The L. S., Co 25
Stuart, D. A., Oil Co., Ltd. 35
Sun Oil Co 24
Sundstrand Machine Tool Co.,
Insert 75-9
T
Taft-Peirce Mfg. Co 7:
Tannewitz Works 36
Texas Company 15
Thompson Grinder Co 11
Threadwell Tap & Die Co. 36
Tide Water Associated Oil
Co 40
Timken Roller Bearing Co.,
(Steel & Tube Div.) 10
Tomkins-Johnson Co 27
Torrington Co 343-37
Triplex Machine Tool Corp. 43
Titeflex, Inc 42
U
U. S. Tool Company, Inc. 12-13
Union Carbide & Carbon
Corp., Haynes Steelite Co.,
Div 10
Union Carbide & Carbon
Corp., Linde Air Products
Co., Div 148-149
Union Twist Drill Co.
Insert 120
Universal Engineering Co 13:
Used Machinery 446-44
V
Van Keuren Co 276
Van Norman Co 8-1
Veeder-Root, Inc. 3
Verson Allsteel Press Co 420
Viking Pump Co 445
Vinco Corporation 348

Westinghouse Electric Corp.	
Walls Sales Corp. 4 Walsh Press & Die Co. 3 Walsh Press & Die Co. 4 Warner & Swasey Co. 28-3 Wesson Company 3 Wesson Metal Corp. 3 Western Tool & Mig. Co., Inc. 4 Westinghouse Electric Corp.	15
Walls Sales Corp. 4 Walsh Press & Die Co. 3 Walsh Press & Die Co. 4 Warner & Swasey Co. 28-3 Wesson Company 3 Wesson Metal Corp. 3 Western Tool & Mig. Co., Inc. 4 Westinghouse Electric Corp.	42
Walsh Press & Die Co. 3 Waltham Machine Works 4 Warner & Swasey Co 28-5 Wesson Company 3 Wesson Metal Corp. 3 Western Tool & Mfg. Co., Inc. 4 Westinghouse Electric Corp. 126-15	38
Warner & Swasey Co. 28-3 Wesson Company 3 Wesson Metal Corp. 3 Western Tool & Mig. Co., Inc. 4 Westinghouse Electric Corp.	17
Warner & Swasey Co. 28-3 Wesson Company 3 Wesson Metal Corp. 3 Western Tool & Mig. Co., Inc. 4 Westinghouse Electric Corp.	40
Wesson Company 3: Wesson Metal Corp. 3: Western Tool & Mfg. Co., Inc. 4: Westinghouse Electric Corp. 126-15	29
Wesson Metal Corp. 3: Western Tool & Míg. Co., Inc. 44 Westinghouse Electric Corp. 126-12	29
Westinghouse Electric Corp.	19
126-12	
126-12	45
	90
Wiedemann Machine Co 30	
Williamson Gear & Mch. Co. 44	10
Wilson, K. R 11	18
Wilson Mechanical Instru- ment Division, American	
Chain & Cable 44	13
Winter Brothers Co.	18
Wood & Spencer Co 42	25
Y	
Yoder Company 14	13
Z	
Zagar Tool, Inc 32	90
Zagar Tool, Inc	36
IN CLASSIFIED SECTION	
Eastern Machinery Co 44	16
Falk Machinery Co 44	17
Gibson Manufacturing Corp. 44	16
Giffels & Vallet, Inc 44	
Godsey, Fred, 44	17
Hyman, Joseph, & Sons 44	17
Miles Machinery Co 44	16
Morey Machinery Co., Inc. 44	17
O K Tool Co 44	
Vermilye Charles 44	179



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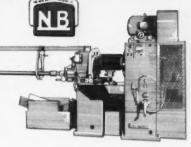
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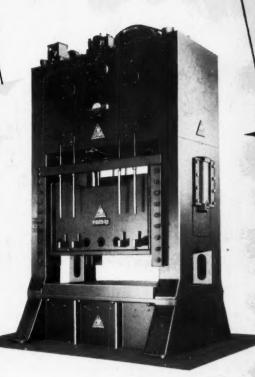


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